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The PD Life Study – Exploring the treatment burden and capacity of people with Parkinson's and their caregivers

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by

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Abstract

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Parkinson's disease (PD) is a common progressive neurological disorder with no cure. People with Parkinson's (PwP) and their caregivers have to do many things to manage their health such as taking different medications, attending appointments and enacting lifestyle changes. This workload of healthcare and its impact is termed 'treatment burden', and the ability to manage this is termed 'capacity'. The PD Life Study aimed for the first time to explore the treatment burden and capacity of PwP and their caregivers and identify key modifiable factors.

Firstly, a **systematic review and qualitative synthesis** of 39 articles identified the main issues of treatment burden in PD which related to managing multiple medications, learning about PD and navigating healthcare obstacles. Secondly, **semi-structured individual interviews** with 17 PwP and caregivers (mean age=73 years) highlighted that difficulties with frequency and access to appointments, receiving appropriate levels of information, organising medications and life adaptations contributed to treatment burden. Aspects of capacity include the ability to drive, access to a car and technology, health literacy, living proximity to healthcare services, personal coping strategies, financial resources, and support from social networks.

Thirdly, a **national survey** amongst 160 PwP (mean age=68 years) and 30 caregivers (mean age=69 years) found that 21% (N=34) of PwP and 50% (N=15) of caregivers reported high treatment burden levels on the Multimorbidity Treatment Burden Questionnaire. Higher treatment burden levels in PwP were associated with frailty, a higher number of non-motor symptoms and higher frequency of medications (>3 times a day). Female caregivers, those caring for someone with memory issues and caregivers with lower mental well-being scores were associated with higher caregiver treatment burden levels. Finally, three **multi-stakeholder focus groups** involving 11 participants (PwP, caregiver and healthcare professionals) discussed the key issues of treatment burden and capacity in PD and made recommendations for improvement. Better communication, expectation setting and appropriate signposting from healthcare professionals, increasing education and awareness of PD, improving flexibility of appointment structures and access to healthcare professionals, and embracing the role of technology were suggested changes at individual-provider and system-levels that could reduce treatment burden.

This thesis has identified aspects of treatment burden and capacity of PwP and their caregivers related to managing appointments, obtaining satisfactory information, organising medications, and enacting lifestyle changes that could be modified to achieve better health outcomes in PD.

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Research Thesis: Declaration of Authorship

Print name: Qian Yue Tan

Title of thesis: The PD Life Study – Exploring the treatment burden and capacity of people with Parkinson's and their caregivers

I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

I confirm that:

This work was done wholly or mainly while in candidature for a research degree at this University;
Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
Where I have consulted the published work of others, this is always clearly attributed;
Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
I have acknowledged all main sources of help;
Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
Parts of this work have been published. Please see Appendix H and Appendix K.

Signature:

Date: 2nd June 2023

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Definitions and Abbreviations

aOR	Adjusted Odds Ratio
AUC	Area under the curve
BGS	British Geriatrics Society; a membership association for professionals specialising in the healthcare of older people across the UK
Burden	Something difficult or unpleasant that you have to deal with or worry about
Bradykinesia	Slowness in the execution of movement
Caregiver	Family or friends or anyone who provides unpaid care or support for someone; this term will encompass carers or care partners
Caregiver burden	The extent to which caregivers perceive that caregiving has had an adverse effect on their emotional, social, financial, physical and spiritual functioning
Caregiver treatment burden	The experience of the workload of healthcare that caregivers have to manage when supporting someone with a long-term condition
CASP	Critical Appraisal Skills Programme; a quality appraisal tool
CBT	Cognitive behaviour therapy
CCI	Charlson Comorbidity Index
CFS	Clinical Frailty Score
CI	Confidence interval
CINAHL	Cumulative Index to Nursing and Allied Health Literature database
CIRS	Cumulative Illness Rating Scale
COPD	Chronic obstructive pulmonary disease
CT scan	Computed tomography scan
DBS	Deep Brain Stimulation
Dopamine	A type of neurotransmitter that sends signals to other nerves via the dopaminergic pathways
Dyskinesia	Abnormal involuntary movements

Definitions and Abbreviations

Embase ..... Medical literature database

Eton's framework ..... Framework of treatment burden by Eton et al

ETQS..... Evaluation Tool for Qualitative Studies

First-order construct..... Quotations from participants in primary qualitative studies

Frailty ..... A state of increased vulnerability to poor resolution of homeostasis following stress

GP..... General Practitioner

H&Y ..... Hoehn and Yahr staging scale for the severity of Parkinson's Disease

HCTD ..... Healthcare Task Difficulty questionnaire

HIV ..... Human Immunodeficiency Virus

ICD-11 ..... International Classification of Diseases 11th revision

IQR ..... Interquartile range

JBI ..... Joanna Briggs Institute

LTC ..... Long-term condition; Chronic health condition with no cure

MCS ..... Mental Component Summary of the SF12v2 quality of life measure

MDS ..... Movement Disorder Society; an international professional society who are interested in PD

MDT ..... Multidisciplinary team

MDS-NMS ..... MDS Non-Motor Rating Scale

MEDLINE ..... Bibliographic database that contains more than 29 million references to journal articles

Mental capacity ..... The ability of someone to make their own informed decisions

MeSH ..... Medical Subject Headings search terms

Motor symptoms ..... Cardinal motor signs and symptoms of PD which include tremor, rigidity, bradykinesia and postural instability

MRI..... Magnetic Resonance Imaging

MTBQ ..... Multimorbidity Treatment Burden Questionnaire

Multimorbidity..... Two or more long-term conditions that cannot be cured but can be controlled through medications or other treatments

NHS.....National Health Service

NICE.....The National Institute for Health and Care Excellence

NIHR .....National Institute for Health and Care Research

NMS.....Non-motor symptoms of PD

NMSQuest .....Non-Motor Symptoms Questionnaire; a self-reported questionnaire for people with Parkinson's

NMSS.....Non-Motor Symptoms Scale; a rater-completed scale to measure the severity and frequency of non-motor symptoms

NPV.....Negative predictive value

Nvivo .....Qualitative data analysis computer software

NVS.....Newest Vital Sign

OR .....Odds ratio

Patient capacity.....The available abilities and resources a patient can mobilise to address the demands healthcare and life make

Parkinson's UK .....Parkinson's research and support charity in the UK

PCS .....Physical Component Summary of the SF12v2 quality of life measure

Psycinfo .....Database for peer-reviewed literature in behavioural science and mental health

PD.....Parkinson's Disease

PDQ .....Parkinson's Disease Questionnaire; a measure of health-related quality of life in Parkinson's Disease

PETS .....Patient Experience of Treatment Burden and Self-Management; a measure of treatment burden

PIFU.....Patient-initiated follow-up appointment system

PPI .....Patient and Public Involvement

PPV.....Positive predictive value

Polypharmacy .....Concurrent use of multiple medications

PRISMA-7 .....Program of Research to Integrate Services for the Maintenance of Autonomy; a frailty measure tool

Definitions and Abbreviations

PROSPERO..... International prospective register of systematic reviews

PwP ..... People with Parkinson's disease

QoL..... Quality of Life

RCT..... Randomised Controlled Trial

REM Sleep..... Rapid Eye Movement Sleep disorder

ROC ..... Receiver operating characteristic curve

Scopus..... Interdisciplinary abstract and citation database

SD..... Standard deviation

Second-order construct ..... Interpretations of the primary qualitative study authors

SF12v2..... Medical Outcomes Study Short Form version 2; a measure of health-related quality of life

SF-36 ..... 36-item Short Form Survey; a measure of health-related quality of life

SILS..... Single-item Literacy Score; a measure of health literacy

SPSS Statistics ..... Statistical Package for the Social Sciences

TBQ ..... Treatment Burden Questionnaire; a measure of treatment burden

TOFHLA ..... Test of Functional Health Literacy in Adults; a measure of health literacy

Treatment Burden ..... The workload of healthcare and its impact on patient functioning and well-being

UK ..... United Kingdom

UPDRS..... Unified Parkinson's Disease Rating Scale; a measure of PD severity

USA ..... United States of America

ZBI ..... Zarit Burden Interview; an instrument used to measure caregiver burden

Overview of Thesis

This PhD thesis will explore the experiences of treatment burden and capacity in people with Parkinson's disease (PwP) and their caregivers. In this thesis, the term 'caregiver' refers to family members or friends who help support and care for PwP and includes other terms such as carers or care partners.

Chapter One of this thesis will describe Parkinson's Disease (PD), how it is managed and how it affects people living with PD as well as their caregivers. I will provide an overview of the literature about the concepts of treatment burden and capacity in people with long-term conditions (LTCs) and why this is important in PD. I will then discuss the current gaps in knowledge and explain why this study is highly relevant to PwP and their caregivers.

Chapter Two will discuss the rationale for choosing to conduct a mixed-methods study to achieve the study aims, as well as any strengths and limitations of each research method including qualitative systematic review, qualitative, and quantitative methodology. Each Work Package will build further on the gained knowledge and lead to the final recommendations for change.

Chapter Three will describe Work Package 1, a systematic review and qualitative synthesis of the treatment burden experiences in PwP and their caregivers.

Chapter Four will describe Work Package 2 which involved qualitative interviews with a local purposive sample of PwP and their caregivers to understand their views and experiences of treatment burden and capacity and identify potentially modifiable factors.

Chapter Five describes Work Package 3 involving a national survey for PwP and their caregivers to determine the extent of treatment burden in PD and explore the factors that contribute to high treatment burden in a wider sample of those affected by PD.

Chapter Six of the thesis will describe Work Package 4 which involved focus groups with key stakeholders to discuss the overall findings and develop recommendations for ways to reduce the treatment burden or enhance capacity of people affected by PD.

Chapter Seven of the thesis aims to integrate the overall study findings and discuss how these fit with current research knowledge. I will then discuss the key modifiable factors of treatment burden and capacity, recommendations for potential changes in clinical practice and policy and the implications for future research.

Chapter 1 Background

1.1 Introduction to Chapter

This chapter will describe Parkinson's disease (PD), including the clinical presentation, diagnosis and management of PD as well as the important role of caregivers in the lives of people with Parkinson's disease (PwP). I will also introduce the concepts of treatment burden and capacity and why this is important for PwP and their caregivers.

1.2 What is Parkinson's Disease?

In 1817, Dr James Parkinson described for the first time the clinical syndrome of 'The Shaking Palsy' based on his observation of six individuals over several years. He described the features of "involuntary tremulous motion, with lessened muscular power, in parts not in action and even when supported; with a propensity to bend the trunk forwards, and to pass from a walking to a running pace: the senses and intellects being uninjured"(1). Termed 'Parkinson's Disease' by Dr Jean-Martin Charcot a few decades later, he refined and expanded this early description and distinguished bradykinesia (slowness in the execution of movement) from rigidity as a cardinal feature of the disease(2). Dr Charcot recognised that PwP do not necessarily have a tremor and are not markedly weak. To date, the diagnosis of PD is made on clinical grounds which can be challenging at times and is described later in this section.

Parkinson's disease is the second most common neurodegenerative disorder in the world after Alzheimer's disease(3). In 2015, PD was identified as the fastest-growing neurological disorder in rates of prevalence, disability, and deaths worldwide(4). The Global Burden of Disease Study reported that the number of people diagnosed with PD worldwide has more than doubled from approximately 2.5 million patients in 1990 to 6.1 million patients in 2016(5). This may be due to increasing awareness of the diagnosis of PD, changes in coding practices and changes in epidemiological study methods leading to the availability of higher-quality studies(5, 6). The prevalence of PD is expected to increase alongside the ageing population(4). It is estimated that 16.4% or 1.4 billion of the global population will be aged 60 years or more by 2030(7). A systematic review and meta-analysis of data from 47 epidemiological studies worldwide reported a rising prevalence of PD with age from 428 per 100,000 individuals aged 60-69 years, to 1087 per

100,000 individuals aged 70-79 years(8). The prevalence increases further with age to 1903 per 100,000 individuals for those aged over 80 years(8). In the United Kingdom (UK), there are approximately 145,000 people diagnosed with PD with both the prevalence and incidence expected to double by 2065 due to the ageing population(9).

Although the underlying cause of PD is unknown, advancing age is the greatest risk factor for the development of PD(3, 10). The diagnosis of PD is rare before the age of 50 years, with 1% of people diagnosed with PD under the age of 50 in the UK(5, 11, 12). The incidence of PD increases with age in both males and females(6, 11). Other than age, gender is also an established risk factor for developing PD. Males are more likely than females to be diagnosed with PD (male-to-female ratio of approximately 3:2)(3). Other risk factors of PD are interlinked and multifactorial, including genetic and environmental factors(3, 13). Although the majority of cases of PD are idiopathic with no established cause, approximately 10-15% of PwP report a positive family history of PD(14). Rare genetic forms of PD with autosomal dominant and autosomal recessive inheritance are recognised risk factors for PD(15). Other environmental risk factors of PD such as pesticide exposure, prior head injury, and rural living have been posited, although no definitive causation has been proven(3). There is increasing evidence that various factors such as tobacco smoking, coffee drinking, alcohol, physical activity and use of calcium-channel blockers and non-steroidal anti-inflammatory drugs are associated with a reduced risk of PD(3, 13, 16). For example, a systematic review and meta-analysis reported that a history of smoking reduced the risk of PD by 36%, although causality has not been proven(16). To date, there are no conclusive protective factors for PD. However, a review of longitudinal studies suggests that there is sufficient evidence to encourage physical activity and moderate caffeine consumption for the primary prevention of PD(17).

Parkinson's disease is predominantly considered a disorder of the basal ganglia, which contains five structures including the striatum (containing the caudate nucleus and putamen), globus pallidus, subthalamic nucleus and substantia nigra. It is an important area of the brain that is responsible for motor control by sending signals through the thalamus to the motor cortex of the brain. The underlying pathogenesis of PD occurs due to the loss of dopaminergic neurons within the substantia nigra(3). This leads to diminished dopamine (a type of neurotransmitter that sends signals to other nerves) levels in the striatum, which is important for controlling movement. Approximately 60-80% of dopaminergic neurons are lost before the motor signs of PD emerge. The aetiology of the loss of dopaminergic neurons in PD remains poorly understood but is hypothesised to be due to protein misfolding, aggregation and toxicity, defective proteolysis, mitochondrial dysfunction and oxidative stress(18). A hallmark of PD is the characteristic deposition of Lewy bodies within the dopaminergic neurons(19). Lewy bodies are predominantly

made up of the α-synuclein protein. In PD, 90% of Lewy body α-synuclein is phosphorylated leading to neuronal death. In PD, the α-synuclein protein changes from a soluble to an insoluble molecule and is unable to be eliminated. However, the causal link between Lewy bodies and neuronal cell death in PD remains inconclusive(19).

1.2.1 Clinical Features of Parkinson's Disease

1.2.1.1 Diagnosis and Motor Symptoms of Parkinson's Disease

Parkinson's disease is a clinical diagnosis based on a comprehensive history and physical examination, which can be challenging. There are currently no reliable diagnostic tests or investigations that can distinguish PD from other conditions with similar clinical presentations(20). The diagnosis of PD can be made using the UK PD Brain Bank Criteria (see Table 1)(21). This is a three-step process that confirms the presence of Parkinsonian syndrome, the absence of any specific exclusion criteria, and the presence of three or more specific supportive criteria.

Table 1: Parkinson's Disease Brain Bank Criteria

Brain Bank Criteria for Diagnosis of Parkinson's Disease(21)
<u>Step 1: Diagnosis of Parkinsonian syndrome</u> Bradykinesia *At least one of the following:* • Muscular rigidity • 4-6 Hz Rest Tremor • Postural instability not caused by primary visual, vestibular, cerebellar, or proprioceptive dysfunction

Step 2: Exclusion criteria for Parkinson's Disease
History of repeated strokes with stepwise progression of Parkinsonian features
History of repeated head injury
History of definite encephalitis
Oculogyric crises
Neuroleptic treatment at the onset of symptoms
More than one affected relative
Sustained remission
Strictly unilateral features after three years
Supranuclear gaze palsy
Cerebellar signs
Early severe autonomic involvement
Early severe dementia with disturbances of memory, language and praxis
Babinski sign
Presence of a cerebral tumour or communicating hydrocephalus on computed tomography scan
Negative response to large doses of levodopa (if malabsorption excluded)
MPTP (1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine) exposure
Step 3: Supportive prospective positive criteria for Parkinson's Disease (≥3 required for the diagnosis of definite Parkinson's Disease)
Unilateral onset
Rest tremor present
Progressive disorder
Persistent asymmetry affecting the side of onset most
Excellent response (70–100%) to levodopa
Severe levodopa-induced chorea
Levodopa response for 5 years or more
Clinical course of 10 years or more

The 2017 National Institute for Health and Care Excellence (NICE) UK guideline for PD in adults recommends that a diagnosis of PD should be suspected in people presenting with the cardinal motor symptoms of tremor, stiffness, slowness, balance problems and/or gait disorders(20). Within the National Health Service (NHS) UK health system, general practitioners (GPs) are often the first point of contact for many patients and are therefore responsible for referrals to the appropriate specialists. Movement disorder specialists who diagnose and manage PD in the UK are typically neurologists or geriatricians. Patients who present with cardinal motor symptoms of PD should have a prompt referral to movement disorder specialists to ensure an accurate clinical diagnosis of PD(20). A single-centre clinicopathological study conducted in the UK over 10 years found that the clinical diagnosis of PD had a positive predictive value of 98.6% when patients are assessed by a movement disorder specialist(22).

1.2.1.2 Non-Motor Symptoms

It is increasingly clear that PD starts many years before the motor symptoms of tremor, rigidity and bradykinesia are evident. Non-motor symptoms (NMS) of PD are sometimes present during the prodromal stage of PD, where cardinal motor symptoms of PD have yet to develop and therefore do not meet the criteria for diagnosis of PD(23). This may lead to delays in the diagnosis of PD. There is now strong evidence that Rapid Eye Movement (REM) sleep behaviour disorder, olfactory dysfunction, and constipation are common symptoms in the prodromal stage of PD(3, 23). These symptoms can occur 20 years or more before the diagnosis of PD. Mood disorders such as depression and anxiety can also present prior to motor symptoms of PD(24). These PD-related NMS may be misinterpreted by patients and physicians alike as related to normal ageing or other co-morbidities.

Although recognised as a movement disorder due to the initial clinical presentation, there are over 40 NMS described by PwP. These NMS can be categorised into neuropsychiatric symptoms, sleep disorders, autonomic symptoms, gastrointestinal symptoms, sensory symptoms and other symptoms(25). There is a high prevalence of neuropsychiatric disorders in PD such as depression, anxiety, apathy, cognitive impairment, dementia and psychotic symptoms(3, 24). A prospective multicentre study of 136 PwP in Sydney over 20 years reported that 75% of the total cohort developed dementia before death(26). At 20 years, 83% of the 30 surviving patients had a diagnosis of dementia. The NMS in PwP including urinary incontinence, symptomatic postural hypotension and dementia subsequently dominate the clinical picture as PD advances, contributing to severe disability, poor quality of life (QoL) and reduced life expectancy(27).

1.2.1.3 Progression of Parkinson's Disease

People with Parkinson's have heterogeneous outcomes following diagnosis, with symptoms gradually progressing over time but with great variability between individuals(3, 28). Not all PwP will experience all the symptoms of PD, or even at the same intensity on a day-to-day basis(29). The time course progression of PD can be divided into four stages: diagnosis, maintenance, complex, and palliative (see Figure 1, page 32)(30, 31). At the diagnosis stage of PD, PwP learn about the diagnosis of PD and attempt to come to terms with this new incurable health diagnosis. Patients may be started on medications to help manage their symptoms at this stage. During the maintenance stage of PD, symptoms of PD are usually well-controlled with PD medications. The complex phase of PD occurs when PD medications start to wear-off, or when patients experience side-effects from long-term use of levodopa medications such as dyskinesia. In the palliative stage, the focus of treatment should prioritise symptom control where possible. It is difficult to

predict how PD will progress for an individual. Indeed, not all PwP will progress to advanced PD and may remain in the maintenance phase. The CamPAIGN study, a prospective cohort study of PwP (N=142) in the UK reported that 23% of patients included in their study had a good outcome at 10 years, with little motor disability and good cognitive levels(32).

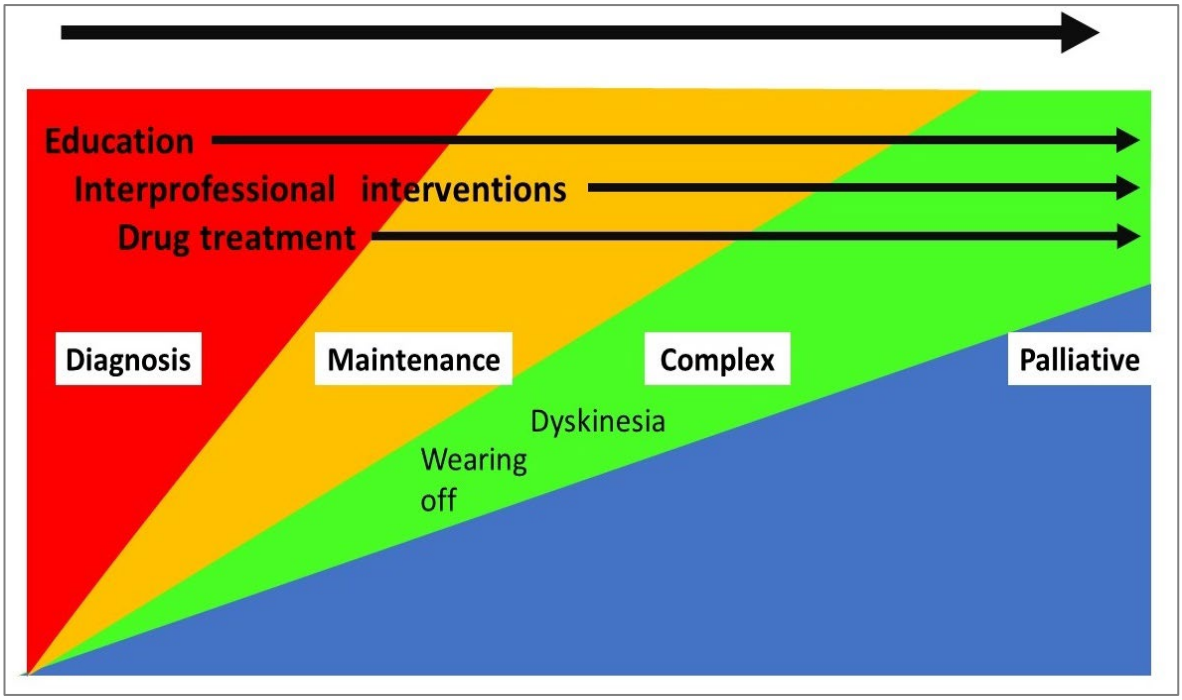


Figure 1: Time course of Parkinson's Disease progression (adapted from MacMahon Thomas Lee Fletcher 2005)(30)

Multiple rating scales have been developed to assess the severity and symptoms of PD with the Hoehn and Yahr (H&Y) scale a well-recognised measure of the progression of symptoms and level of disability of PwP (see Table 2)(33). Broadly speaking, mild or early PD includes H&Y stages 1 and 2, where symptoms progress from unilateral to bilateral involvement. During mild or early PD, PwP can live independently. Stage 3 of H&Y is considered mid-stage PD, where PwP experience loss of balance (typically starting to fall) and slowness of movement that can impair daily activities but are still able to live independently. Advanced PD includes H&Y stages 4 and 5. At H&Y stage 4, symptoms of PD lead to severe disability with patients requiring assistance to stand and walk. Patients at H&Y stage 5 have progressed to the advanced stage of PD where they are required to use a wheelchair or are predominantly bedbound unless assisted. Many PwP do not reach stage 5 or even stage 4 of disease severity.

Table 2: Hoehn and Yahr Scale for Staging of Parkinson's Disease

Severity	Stage	Hoehn and Yahr Staging
Mild or Early PD	**1**	Unilateral involvement only usually with minimal or no functional disability
	2	Bilateral involvement without impairment of balance
Mid-stage PD	**3**	Mild to moderate bilateral disease; some postural instability; physically independent
Advanced PD	**4**	Severe disability; still able to walk or stand unassisted
	5	Wheelchair-bound or bedridden unless aided

1.2.2 Parkinson's: An exemplar of multimorbidity and frailty

PwP are often older, and also have multimorbidity and frailty(34). Multimorbidity is defined as "two or more long-term conditions (LTCs) that cannot currently be cured but can be controlled through medications or other treatments"(35). Frailty is a distinctive health state of increased vulnerability to poor resolution of homeostasis following a minor stressor event(36). Like PD, the prevalence of multimorbidity and frailty also increases with age(37). Multimorbidity currently affects two-thirds of people aged 65 years and over in the UK(37). Approximately 10% of people aged over 65 years in the community are living with frailty, rising to 25-50% of those aged over 85 years(36, 38). Patients with multimorbidity are at higher risk of functional decline, greater use of healthcare, poor QoL and increased rates of mortality(35). Frailty increases the risk of adverse outcomes including falls, delirium and disability(36). A systematic review and meta-analysis of 48 observational studies reported that seven out of 10 patients with frailty have multimorbidity, whilst almost a fifth of adults with multimorbidity also have frailty(39). The review only included studies that measured frailty based on the Fried criteria, which defined frailty as the presence of at least three of the following: weight loss, low hand grip strength, slow gait speed, exhaustion and reduced physical activity. However, multiple other frailty measurements exist with no current international standard measurement(40). It is also important to note that ageing per se does not directly lead to multimorbidity and frailty. Equally, although there appears to be a bidirectional relationship between multimorbidity and frailty, there remains no definitive evidence of the causal association and further research is required to conclusively determine the relationship between multimorbidity and frailty(39).

PwP have multiple other LTCs which may or may not be related to the underlying neurodegenerative disorder. A large cohort study (N=510,502) from a primary care database in Scotland found that PwP (N=2650) had higher numbers of physical and mental co-morbidities compared to patients without PD (31% had >5 comorbidities vs 13% without PD, p<0.001)(41). In this study, 12 out of 30 physical conditions were significantly more prevalent in PwP, with epilepsy and constipation being the most significant. Epilepsy has not been associated with PD and can be considered a discordant comorbidity(41). A longitudinal study in Spain compared comorbid conditions in PwP (N=147), Alzheimer's disease (N=44) and a control group (N=44)(42). They found that discordant comorbidities such as disorders of the circulatory system and endocrine, nutritional and metabolic diseases were also frequently seen and increased significantly over time in PwP(42). Comparatively, constipation is a prominent symptom of PD and therefore concordant comorbidity(41, 43). Concordant comorbidities in PD such as bladder and bowel dysfunction, orthostatic hypotension and neuropsychiatric disorders are more common in PwP and part of the recognised spectrum of NMS in PD(43, 44). A small population-based cohort study in the United States of America (USA) compared the spectrum of comorbidity in an incident PwP group(N=197) to age- and sex-matched participants without PD in the five years before the onset of disease and subsequent 15 years(44). Prior to the diagnosis of PD, there were no significant differences in comorbidities compared to the control group. However, following the diagnosis of PD, PwP had significant comorbidity compared to their matched peers, reflecting concordant comorbidities and recognised sequelae of PD.

Both PD and frailty are conditions that commonly affect older people. In 2008, Ahmed et al first reported that frailty was more prevalent in PwP(45). Their observational, cross-sectional single-centre analysis of a small sample size (N=50) of PwP found that 33% of patients with optimally controlled PD met the criteria for diagnosis of frailty using the Fried criteria. A systematic review (N=8) found that PwP have a higher prevalence of frailty compared to the older population (between 29-67% depending on the frailty measure used)(46). No measures of frailty have been specifically validated in PwP. However, the underlying neurodegenerative process in PD leads to a gradual decline in motor and non-motor physiological systems often resulting in slow walking speed, fatigue and weight loss in PwP(46). This may lead to the overdiagnosis of frailty in PD as the clinical picture may overlap with frailty measures(47). A more recent systematic review and meta-analysis (N=37) by McMillan et al was conducted to determine the prevalence, associations and outcomes of frailty in PD(48). There was large heterogeneity in the included studies (I^2=92.6%, p<0.01), with half published as abstracts only. They reported found that PD characteristics such as longer duration of PD diagnosis, higher H&Y stages, worse PD motor severity and non-tremor dominant PD were associated with frailty. Frailty was associated with

poor outcomes including falls, orthostatic hypotension, cognitive impairment, dementia, fatigue, hallucinations, increasing dependency and nursing home placement in PD. Therefore, PwP with coexisting frailty may have an increased risk of functional decline, disability, increased healthcare use and mortality(36, 48, 49).

1.3 Management of Parkinson's Disease

Unfortunately, PD is a LTC with no cure. Furthermore, the management of PD varies widely based on many individual patient factors such as the patient's age, stage and progression of PD and presence of comorbidities. The main goal of management should be to maintain acceptable levels of functioning and independence in PwP(29). This can be achieved with input from a multidisciplinary team (MDT) and a careful combination of pharmacological and non-pharmacological management. In some patients with PD, surgical management with deep brain stimulation (DBS) may be appropriate. Management of PD should account for patient complexity and consider their wishes and needs with an individualised and holistic approach to patient care(20, 50).

1.3.1 Pharmacological Management

1.3.1.1 Motor Symptoms

Oral medications, often with complex polypharmacy (use of multiple medications) remain the mainstay of treatment and symptom control in PD, allowing PwP to improve their functional status and QoL(29). Typically, many PwP will require the addition of more antiparkinsonian medications as PD progresses, with increased dosage and frequency of medications(29). Dopamine precursor (levodopa) is the most effective medication that helps manage the symptoms of PD. Studies have supported starting levodopa three or four times a day early on after diagnosis of PD(29). Levodopa is recommended by NICE guidelines as the first-line treatment for people in the early stages of PD whose motor symptoms have an impact on their QoL(20). Motor symptoms of PD such as bradykinesia and rigidity respond well to levodopa in the initial stages of PD(51). Levodopa tends to be well-tolerated by PwP, with initial side-effects of nausea and gastrointestinal symptoms settling over time(19). However, long-term levodopa treatment may lead to motor fluctuations such as "wearing-off" (when motor symptoms return before the next dose of levodopa is due) and dyskinesia (abnormal involuntary movements)(3, 51). Approximately 40% of PD patients develop levodopa-induced dyskinesia 4-6 years after starting

levodopa(29). Another complication of long-term levodopa treatment is drug-induced psychosis such as hallucinations and confusion. Therefore, as PD progresses any benefits of higher doses of levodopa need to be carefully balanced against the potential side-effects(51).

Other oral antiparkinsonian medication classes that can be started in the initial stages of PD or used as adjunctive therapy with levodopa include dopamine agonists, monoamine oxidase (MAO-B) inhibitors, catechol-O-methyl transferase (COMT) inhibitors or glutamate antagonists (see Table 3). These medications are also not without side-effects, such as orthostatic hypotension, hallucinations, or impulse control disorders including pathological gambling, hypersexuality, compulsive shopping or eating. In advanced PD, motor symptoms of postural instability, freezing of gait, dysphagia and dysarthria respond poorly to antiparkinsonian medications(52). If oral therapy cannot be optimised, apomorphine administered via intermittent or continuous subcutaneous injection through a portable pump may be beneficial(29). Alternatively, levodopa-carbidopa gel infusion delivered directly into the proximal jejunum may be considered(20). This infusion first requires the person with PD to undergo a surgical procedure guided by endoscopy to allow placement of the percutaneous endoscopic jejunostomy tube.

Table 3: Pharmacological Management of Motor Symptoms

Medication Class *(Examples)*	**Indications for Use**	**Potential side-effects**
Dopamine Precursors *(Levodopa, Carbidopa)*	Most effective medication for PD Can be used in both early and advanced stages of PD	Abnormal involuntary movements and dyskinesia Orthostatic hypotension (falls risk)
Oral Dopamine Agonists (*Pramipexole, Ropinirole)*	Second most effective medication Reduction in off-time	Impulse control disorders Orthostatic hypotension Hallucinations
Monoamine oxidase-B (MAO-B) inhibitors *(Rasagiline, Selegiline)*	Can be used as initial therapy in early PD or as an adjunct to levodopa Reduction in off-time	Orthostatic hypotension Confusion Hallucinations
Catechol-O-methyl transferase (COMT) inhibitors *(Entacapone, Opicapone)*	Adjunct with levodopa dose if wearing off occurs Reduction in off-time	Dyskinesia May cause diarrhoea Colour urine orange

Glutamate Antagonist *(Amantadine)*	Treatment of dyskinesia in early or later PD where modification of existing therapy does not help	Orthostatic hypotension Confusion Hallucinations
Liquid Dopamine Agonist *(Apomorphine)*	Used in advanced PD and administered subcutaneously Effective in refractory motor fluctuation	Skin nodules Nausea
Levodopa-carbidopa intestinal gel	Used in advanced PD Effective in reducing motor fluctuations	Potential adverse events during percutaneous endoscopic jejunostomy procedure

1.3.1.2 Non-Motor Symptoms

Non-motor symptoms in PD are less responsive to levodopa and current therapies are limited, with a lack of evidence-based high-quality studies(53, 54). Furthermore, dopaminergic medications that are beneficial for motor symptoms may in contrast worsen or even induce some NMS such as psychosis, impulse control disorder or constipation(54). Therefore, pharmacological management of NMS is complex and differs based on the severity of symptoms, level of disability, and impact on QoL for individual patients(3). Assessment of potential contributing factors of NMS including a review of current PD medication regimens or polypharmacy is important when managing NMS(54). For example, PwP who develop orthostatic hypotension should have a review of concurrent medications such as anti-hypertensives, dopaminergic precursors, anticholinergics, and antidepressants as these medications can exacerbate symptoms of orthostatic hypotension(20). Given the vast number of NMS, any additional medications to manage NMS must be carefully considered.

1.3.2 Non-Pharmacological Management

Non-pharmacological management in conjunction with pharmacological management has an important role in PD(55). For example, exercise and physical activity have been shown to improve both motor and NMS(56). Bhalsing et al conducted a review of systematic reviews and meta-analysis (N=19) of the effects of specific types of exercises on motor symptoms in PD(56). They reported that various types of physical activity including aerobics, treadmill training, progressive resistance training, dance, tai chi and yoga demonstrated improvement in motor symptoms.

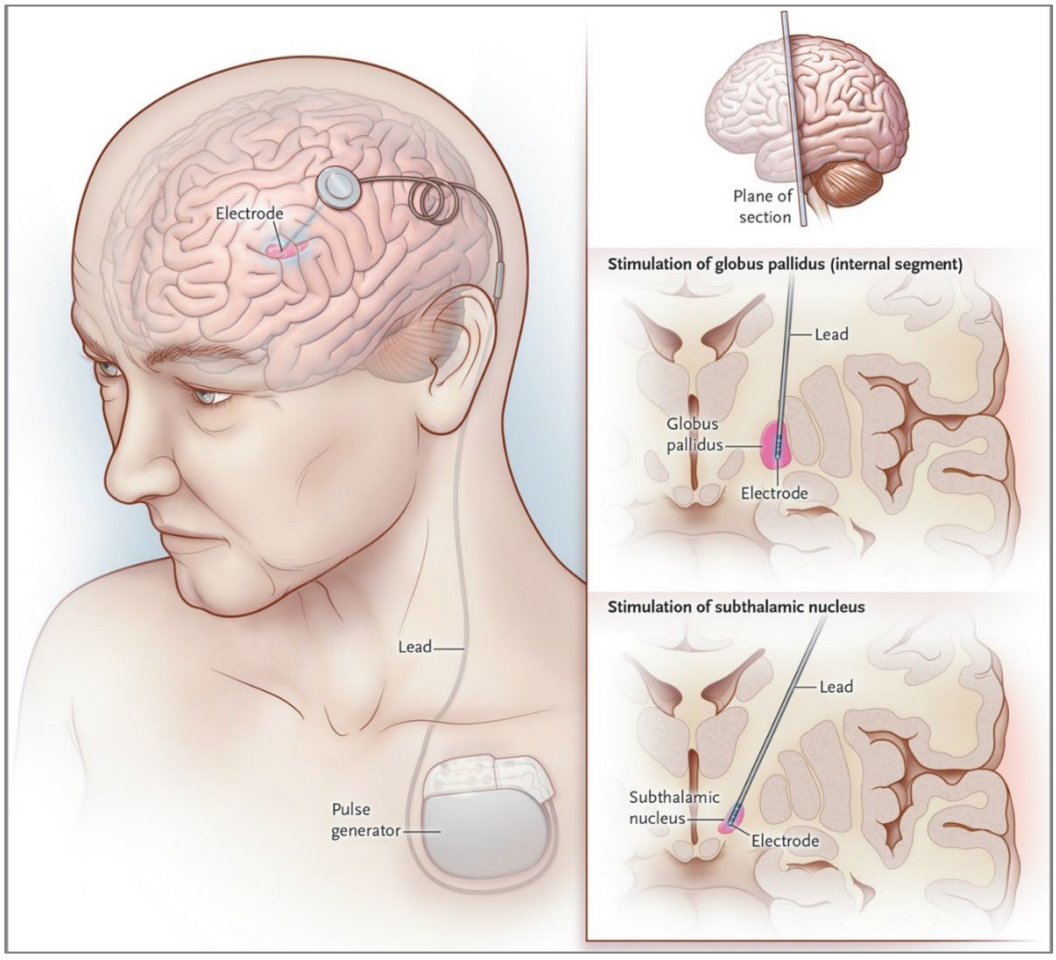
Although most studies have shown the beneficial effects of physical activity, there remains no consensus on how to prescribe and deliver exercise or physical activity to PwP(56). The NICE guidelines recommend referral of PwP in the early stages of PD to a physiotherapist with experience with PD as physiotherapy can help PwP manage symptoms, maintain independence and prevent hospital admission(20). Parkinson's UK, the primary PD research and support charity in the UK have developed a "Parkinson's exercise framework" that recommends mobility, balance, coordination and strength exercises from the point of diagnosis of PD(57). There are Parkinson's UK support groups available across the UK that organise exercise classes locally to help PwP stay active.

The NICE guidelines on non-pharmacological management in PD also recommend referrals to other members of the MDT such as occupational therapists, speech and language therapists, or dieticians for specialist advice if required(20). Occupational therapy can help create safer environments and provide suitable equipment to PwP that helps maintain their independence(29). This is effective in improving daily activities and may be associated with a reduction in institutional care for PwP, although further conclusive evidence is required(55). Speech and language therapy can improve speech and swallowing for patients who have difficulties with communication and/or swallowing(29). For example, the Lee Silverman voice treatment intervention has been shown to reduce hypophonia and hypokinetic dysarthria in PD(29). Supportive management with nutrition and dietary changes such as increasing protein intake in the main meal of the day may be effective for PwP who experience motor fluctuations with levodopa(20). Other non-pharmacological management such as cognitive behaviour therapy (CBT) may potentially be efficacious in the treatment of depression and impulse control disorder although there remains insufficient evidence on the safety profile of CBT in PwP(54). Computer-based cognitive training has also been reported as potentially beneficial in improving memory, executive function, processing speed and attention in PwP(58).

1.3.3 Deep Brain Stimulation

In a few patients (1-10%) with PD, treatment with DBS may be appropriate(59). Deep brain stimulation is a neurosurgical procedure for patients with advanced PD for whom optimal medical therapy fails to control their symptoms of motor fluctuations, dyskinesia and tremor(20). Successful DBS leads to a decrease in the number of medications or improved medication regimes for PwP as well as improved QoL(60, 61). However, it is not a cure and does not stop PD progression. The surgical procedure requires the implantation of one or more permanent electrodes in specific brain structures, sometimes within both sides(60). The brain structures that

are most targeted in PD are the subthalamic nucleus and the internal segment of the globus pallidus (see Figure 2)(60). The assessment process for DBS takes a few months and involves the review of movement problems with video recordings, neuropsychological assessments, and detailed brain imaging with magnetic resonance imaging (MRI). If PwP are considered suitable, the first stage of the surgery involves local anaesthetic into the scalp to temporarily fix the stereotactic frame to the skull. Further brain imaging with either a Computerised Tomography (CT) or MRI scan is then conducted to help determine the trajectory and placement of electrodes in relation to the stereotactic frame. DBS surgery is often performed whilst the patient is awake to help guide the electrode to the precise location of the brain. The second stage of the surgery usually occurs two to four weeks after the initial stage, where electrodes are connected to a pulse generator that is implanted on the anterior chest wall. Following this, the stimulator is programmed and adjusted over a few months, with appropriate alterations to PD medications based on response to stimulation.

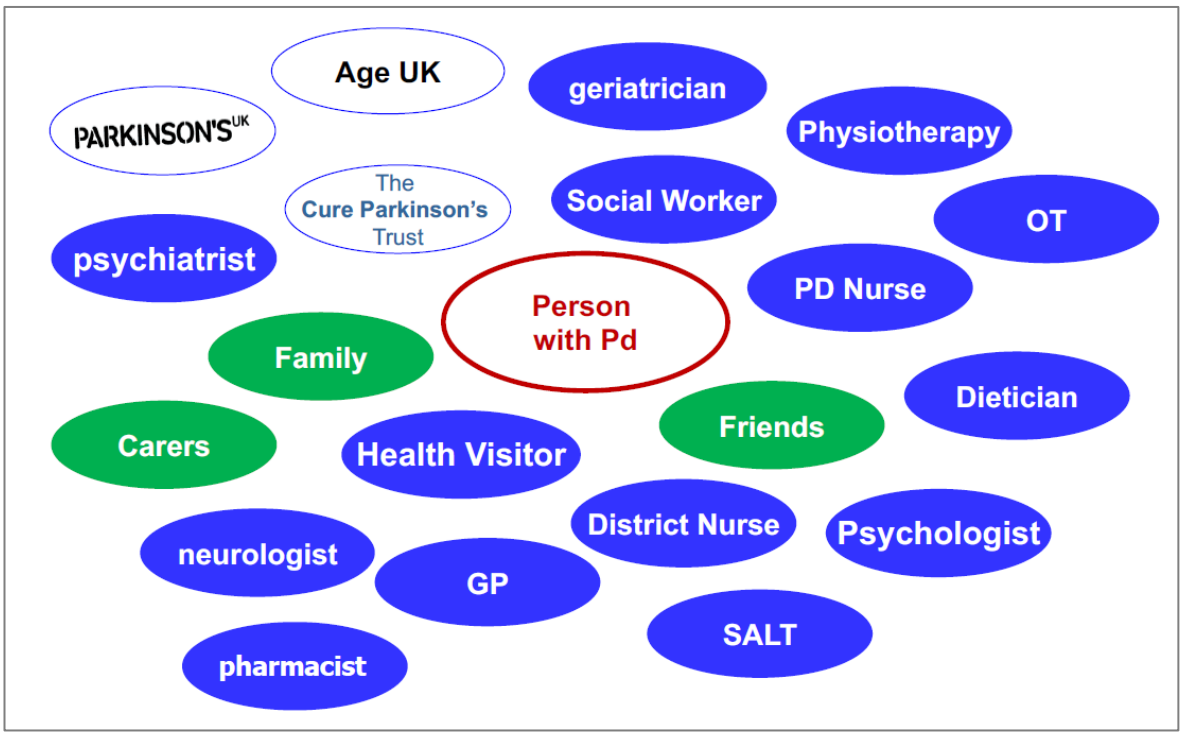


Reproduced with permission from Okun MS. Deep-Brain Stimulation for Parkinson's Disease. New England Journal of Medicine. 2012;367(16):1529-38; Copyright Massachusetts Medical Society.

Figure 2: Electrode Implantation for Deep Brain Stimulation(60)

1.3.4 Healthcare Organisation in Parkinson's Disease

In addition to the management of PD with pharmacological, non-pharmacological treatments and DBS, the person with PD may have to navigate through multiple healthcare organisations to monitor their health. In the UK, the patient journey for PwP begins when the diagnosis of PD is suspected and a referral to specialist clinics is made by their GP. PD specialists may be a geriatrician or neurologist. Once PD is confirmed, the NICE guideline for PD recommends that PwP should be reviewed every 6-12 months by PD specialists(20). PwP including their family and friends are closely supported by a MDT (see Figure 3)(20, 29, 30). PwP and their caregivers should have regular access to a PD nurse specialist for additional support and advice. The PD nurse specialist also has an important role in clinical monitoring and medication adjustments as well as a central coordination role in the MDT involved in the care of PD(29). Depending on symptoms, referral to other members of the MDT including physiotherapists, occupational therapists, speech and language therapists, dieticians and psychologists should be considered. There may also be involvement of other services such as mental health (old age psychiatry) and palliative care(20).



GP, General Practitioner; OT; Occupational Therapist; PD, Parkinson's Disease; SALT, Speech and Language Therapist

Figure 3: The Multidisciplinary Team in Parkinson's Disease

In the UK, there are considerable variations between local PD services regarding service configuration, management structure, population density and availability of transport(62). The 2019 UK Parkinson's audit reported that most PD services (51%) conducted joint or parallel clinics with doctors and PD nurse specialists, whilst a proportion of clinics (31%) are staffed by a doctor alone(63). A fully integrated clinic model service is available at 18% of all clinics within the UK. This integrated clinical model aims to deliver an MDT consisting of a consultant, a PD nurse specialist, and therapists all seeing patients within the same clinic session if required.

1.4 Caregiver Role in Parkinson's Disease

As PD progresses with increasing disability, many PwP require someone to help support and care for them. Family members and friends often become informal caregivers and play an important role in the well-being and lives of someone with PD. Most caregivers of PwP are spouses or partners who are also older(64). Caregivers themselves may also be diagnosed with a LTC such as hypertension, depression, arthritis or osteoporosis(65). Caring for someone with PD may cause significant burdens for caregivers and affect their physical, emotional, and social aspects of QoL(65). They may support the person with PD with activities of daily living and also take on other responsibilities such as helping with medications, attending clinic appointments, advocating on behalf of their loved one, surveillance of falls and providing emotional support(66). This may require significant time investment from the caregiver leading to changes in their role and new daily routines(67, 68). Demands on caregivers are likely to increase during the later stages of PD, including the last months of life of the person the PD particularly with increasing symptom burden and disability(64, 66). A survey of recently bereaved caregivers of PwP (N=47, mean age=68 years) in the USA reported that caregivers assisted with a mean of 13 out of 17 possible activities of daily living in the last months of life(64). Assisting with these activities took a median of six hours per day. The survey included caregivers of patients with PD who were living in a nursing home or long-term care facility, in their own homes or admitted to a hospital. Caregivers rated assisting with toileting as the most difficult activity, followed by assisting the person with PD to get out of bed or chair and assisting them with bathing. Despite being heavily involved in the care of the person with PD, at least one-third of caregivers reported that they did not feel prepared to cope with emergencies or the substantial physical needs and the overall stress of caregiving at the end of life.

1.4.1 Caregiver Burden in Parkinson's Disease

Caregiver burden is defined as "the extent to which caregivers perceive that caregiving has had an adverse effect on their emotional, social, financial, physical and spiritual functioning"(69). A systematic review (N=110) found that caregiver burden in PD is associated with factors related to PD motor symptoms such as motor fluctuations, dyskinesia, gait dysfunction, postural instability and falls, as well as neuropsychiatric symptoms of PD such as depression, anxiety, apathy, cognitive impairment, psychosis, impulse control disorders and sleep disorders(66). Other factors that contribute to caregiver burden are related to DBS (worsening of existing NMS) and factors related to diagnosis and information about PD. Furthermore, caregiver factors associated with caregiver burden in PD include psychiatric symptoms of the caregivers, coping and adapting to the situation as well as support from social networks. Multiple studies have shown that NMS of PD are a major cause of caregiver burden and poor caregiver QoL(65, 67, 70). A large study of PwP and their caregivers (N=584) in Spain found that caregivers of patients with neuropsychiatric symptoms (mood, apathy and psychosis) reported significantly higher caregiver burden than those without symptoms ($p<0.001$)(71). They reported a significant difference in caregiver burden levels relating to patients with PD dementia compared to those without dementia ($p<0.001$). However, many caregivers also reported positive aspects including improved family bonds and how having an optimistic outlook helped them cope with the challenges of being a caregiver and helped maintain their own well-being(68). Having multiple sources of support from support groups, family, financial support, and easily accessible healthcare services may help family members of PwP carry out their role as caregivers(68).

Whilst the impact of patients' symptoms and disability on caregiver burden in PD is well recognised, no studies have specifically explored the impact of helping the person with PD with healthcare tasks (taking medications, attending appointments, lifestyle changes etc.) on caregivers. This is termed "caregiver treatment burden" and is described later in this chapter (see section 1.9, page 58).

1.5 Treatment Burden and Patient Capacity

Managing the progressive symptoms of PD, multiple medications and interactions with numerous healthcare professionals when living with PD as described earlier in this chapter may cause treatment burden in PwP and their caregivers. **Treatment burden** can be defined as "the workload of healthcare and its impact on patient functioning and well-being"(72). May et al's paper in 2009 introduced the concept of treatment burden and called for the identification of

treatment burden in patients with LTCs(73). They provided examples of four patients with LTCs including heart failure and diabetes who described the burden of healthcare due to multiple appointments to specialist clinics (54 appointments in the past two years), taking medications at 11 separate times a day, taking notes of every medication dose to ensure adherence due to their complex medication regime, as well as the financial cost of medications. The work of managing a LTC impacts not only healthcare services but also patients and their caregivers, particularly as the responsibility of managing the illness moves away from health professionals onto self-management by patients and caregivers.

Recognised work that patients have to do to manage their health includes learning about and understanding their health condition, taking and managing multiple medications, attending and coordinating medical appointments, navigating various health and social care systems, monitoring changes in their symptoms and health as well as lifestyle changes such as diet or exercise(74). This requires a considerable amount of effort not just from patients, but also from their caregivers or social networks(75). The workload of healthcare can be time-consuming, require high levels of literacy and numeracy and at times come at a personal financial cost(76). This needs to be accomplished on top of the everyday demands of life and responsibilities such as family, parenthood, caregiving, employment, travel and transportation(76). Therefore, living with a LTC means having to manage the work of being a patient in one's everyday life. Furthermore, the demands on patients can be exacerbated by disease-centred clinical guidelines and uncoordinated and complex healthcare systems(77, 78). All this can be overwhelming to patients, leading to high treatment burden(79). This may be exacerbated in patients with multimorbidity(80).

Patient capacity, defined as the ability to manage the workload of healthcare is an equally important aspect of treatment burden. Patient capacity is a complex concept, with various influencing factors that are discussed in Section 1.7 (page 53). In patients with a LTC, the imbalance between the treatment burden and patient capacity may potentially lead to poor outcomes. This is described further in the next section.

1.5.1 The Cumulative Complexity Model

The Cumulative Complexity Model (see Figure 4, page 44) by Shippee et al describes the dynamic relationship between patient workload and patient capacity(76). Patient complexity is driven by imbalances between workload and capacity. As shown in Figure 4, patients whose workload outweighs their capacity will experience high treatment burden. Increasing the workload without

an associated increase in patient capacity may lead to poor outcomes. Similarly, if patient capacity decreases, the treatment burden experienced increases. This imbalance between workload and capacity influences patients' ability to access and utilise available health services (73, 76). Furthermore, it also affects their ability to comply with self-care recommendations and recommended treatment regimens, with some patients taking an active decision to stop, modify or reduce their treatments(81). This consequently leads to poor health outcomes(76). In response to poor outcomes, clinicians that are guided by disease-specific outcomes may intensify treatments and could unfortunately increase the treatment burden rather than address the various factors of patient capacity or illness burden(73, 76, 81).

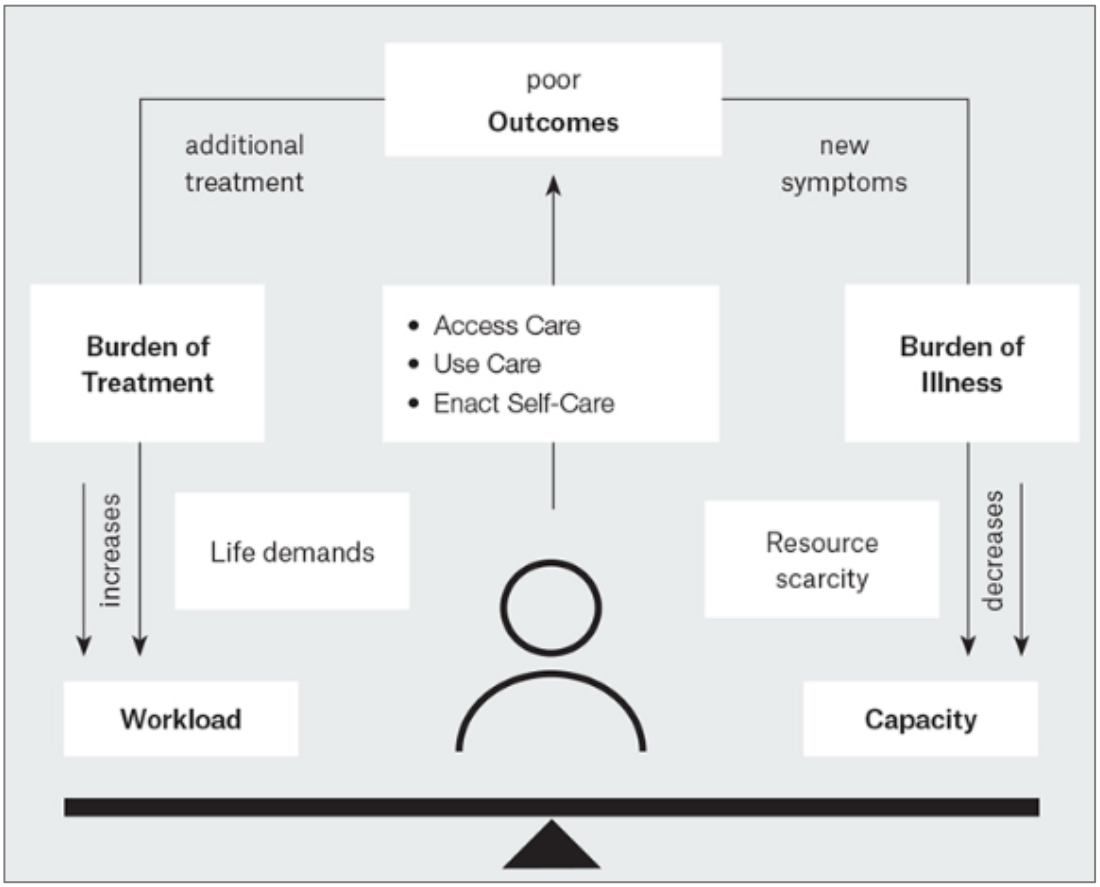


Figure 4: The Cumulative Complexity Model adapted by Trevena et al(76, 82)

The Cumulative Complexity Model forms the theoretical basis underpinning "Minimally Disruptive Medicine", as clinicians work towards preventing, diagnosis and treating workload-capacity balance in patients with multimorbidity(83). May et al called for a patient-centred approach to care that seeks to reduce the workload of treatment burden for both patients and their caregivers by considering patient priorities in life and health(73). This approach may be appropriate for patients with multimorbidity who may be at risk of feeling overburdened due to the demands of

life, illness and health(83). The four principles of Minimally Disruptive Medicine include the need to establish the weight of treatment burden, encourage coordination in clinical practice, acknowledge comorbidity, and prioritise from the patient's perspective. To achieve this, there needs to be explicit clinical practice guidelines for when to assess treatment burden and a standardised method to assess treatment burden(78, 84).

1.5.2 Why is treatment burden important?

High treatment burden is associated with low adherence to medications and less satisfaction with medication, wasted healthcare resources, worse QoL, and more distress for patients(73, 80, 85-87). Studies have shown that factors that are associated with high treatment burden include patients with higher number of LTCs and healthcare appointments, the presence of unpaid carers, mental health issues, a lack of established routine for self-management, low health literacy, low self-efficacy and a lack of social support(79, 80, 88). Interestingly, younger patients with LTCs experience higher treatment burdens compared to older people(79, 80). This may be because older people perhaps accept that the work of looking after their health is a necessary part of ageing and become more accustomed to the workload(79). Conversely, younger patients may have different outlooks on how their health may impact their lives and must juggle complex treatment regimens with social expectations of having to work or care for others(80). In addition, patients with higher treatment burden may not consent to participate in research studies due to time constraints or illness exacerbations(72).

The increasing prevalence of patients with LTCs and multimorbidity who have a high workload of healthcare highlights the urgent need to identify and address their treatment burden. This is an important step towards achieving patient-centred care and improving QoL and health-related outcomes(73, 78). However, current clinical guidelines for LTCs fail to take into account patients' multimorbidity with a lack of integrated care pathways potentially leading to high treatment burden for patients and caregivers who attempt to comply with clinicians' recommendations based on disease-specific guidelines(78). For example, results from a systematic review of clinical guidelines for six LTCs (hypertension, diabetes, coronary heart disease, chronic obstructive pulmonary disease (COPD), knee osteoarthritis and depression) reported that patients diagnosed with three LTCs who comply with each disease-specific guidelines would take a maximum of 13 medications daily, visit a healthcare professional up to six times a month and spend a mean of 49 hours per month managing the workload of healthcare(89). Recognising the importance of treatment burden in multimorbidity, NICE published its first clinical guideline for multimorbidity in 2016. This guideline emphasises the need to establish the treatment burden and focus on patient-

centred care, taking into account their values, goals and priorities(90). There has also been a proposal that treatment burden should be regarded as an indicator of the quality of healthcare in the UK(91). It has been suggested that perhaps a simple way of addressing the treatment burden is to ask patients with LTCs or multimorbidity, *"Can you really do what I'm asking you to do?"*(91). However, although treatment burden is an emerging and important concept, there remains no universal definition or method to assess treatment burden(78, 84, 92).

1.6 Concepts of Treatment Burden

Since May et al's vital paper in 2009, several key papers that explore the concepts of treatment burden and capacity have been published in the last decade. Each paper used various methods to explore these complex concepts further. Quantitative measures of treatment burden have also been developed to determine the levels of treatment burden in patients with LTCs. These concepts and measures of treatment burden (see Figure 5) will be explored further in chronological order in the next sections of this chapter.

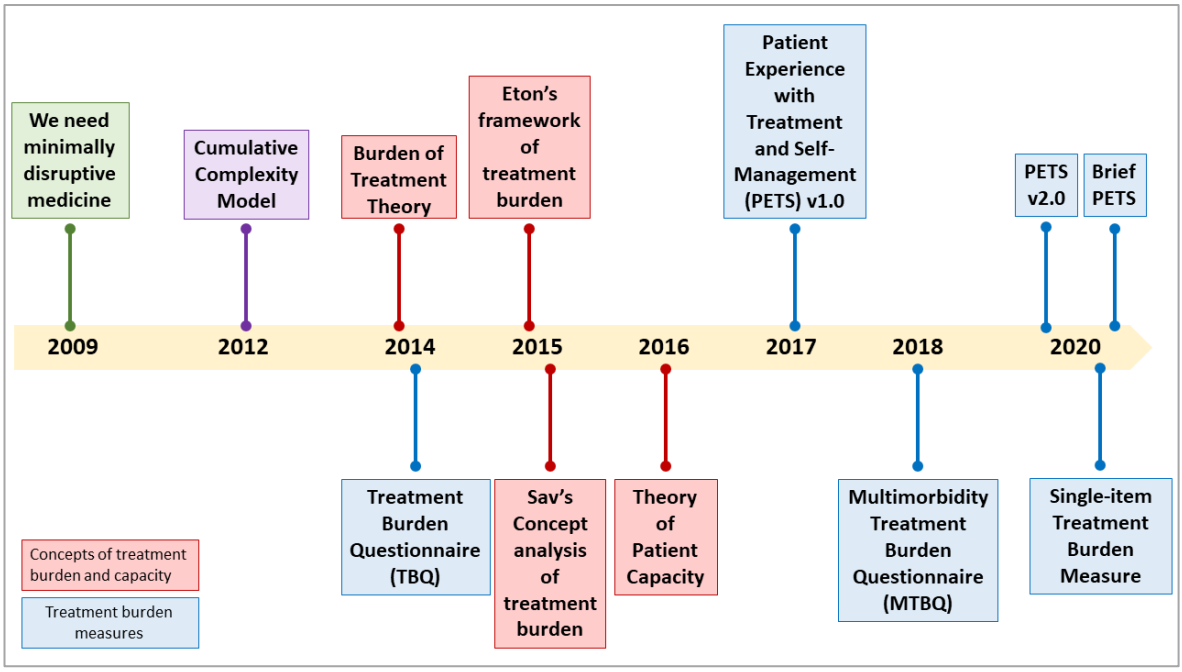


Figure 5: Timeline of the development of treatment burden and capacity concepts

1.6.1 Burden of Treatment Theory

May et al's Burden of Treatment Theory introduces an important structural model to understand the relationship and interaction between patients, their social networks and healthcare services(75). Increasing responsibilities of looking after their health is placed on patients and their social networks by healthcare systems. This includes organising and coordinating their care, adhering to complex treatment and self-monitoring regimens, and a range of expectations for personal motivation, expertise, and self-care. This workload of health occurs alongside the demands and responsibilities of everyday life. The Burden of Treatment Theory aims to understand the interaction between patients' capacity for action and how they must meet the demands that healthcare systems place. It describes that patients must manage this complex work together with support from their relational networks, which not only include their social networks but also healthcare and other professionals. Patient capacity is not just an individual's potential ability to manage the workload of healthcare. Along with their social networks, patient capacity relies on the ability to secure cooperation from others and obtain resources to add to their social capital. This contributes to their structural resilience, which is their ability to absorb adversity (see Figure 6).

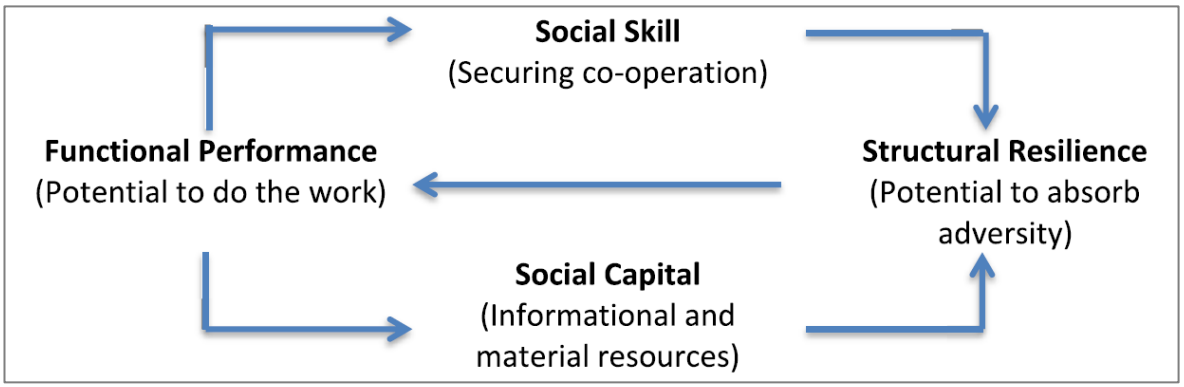


Figure 6: The Burden of Treatment Theory(75)

Furthermore, maximal benefits of healthcare services can only be gained if patients are given the resources to utilise them. For example, they highlight the impact of the wider healthcare system and the availability of social and economic resources on improving or worsening the treatment burden experienced. The Burden of Treatment Theory provides a structural model to understand the relationship between treatment burden and patient capacity at an individual, societal, and systemic level. It helps to acknowledge discrepancies in healthcare utilisation and adherence in different healthcare settings and clinical contexts.

1.6.2 Eton's framework of treatment burden

Eton et al developed an initial conceptual framework of treatment burden following semi-structured interviews (N=32) with patients from a large, academic medical centre in the USA(72). Participants were at least 18 years old with one or more chronic health conditions and had complex regimens of self-care such as polypharmacy, monitoring health, diet and exercise. The initial framework was refined by conducting interviews with participants (N=18) recruited from a hospital that provides care for many low-income and vulnerable persons regardless of their insurance status or ability to pay to ensure representation from diverse backgrounds(74). Eton et al then conducted four focus groups (N=25) with patients with chronic diseases (heart failure, renal failure, and diabetes) to test and confirm the final framework of treatment burden(74). The theme "problem-focused strategies and tools to facilitate the work of self-care" was removed from the final framework as they felt that these strategies were actively chosen, rather than obligatory self-care activities that patients are required to do for their health(74). Ridgeway et al described these as factors that may lessen the perceived treatment burden in patients with LTCs, which could be construed as aspects of patient capacity(93). This led to Eton's final framework of treatment burden (Figure 7) which encompasses three main themes: 1) the work patients must do to care for their health, 2) challenges and stressors that exacerbate perceived burden, and 3) the impacts of burden(72, 74).

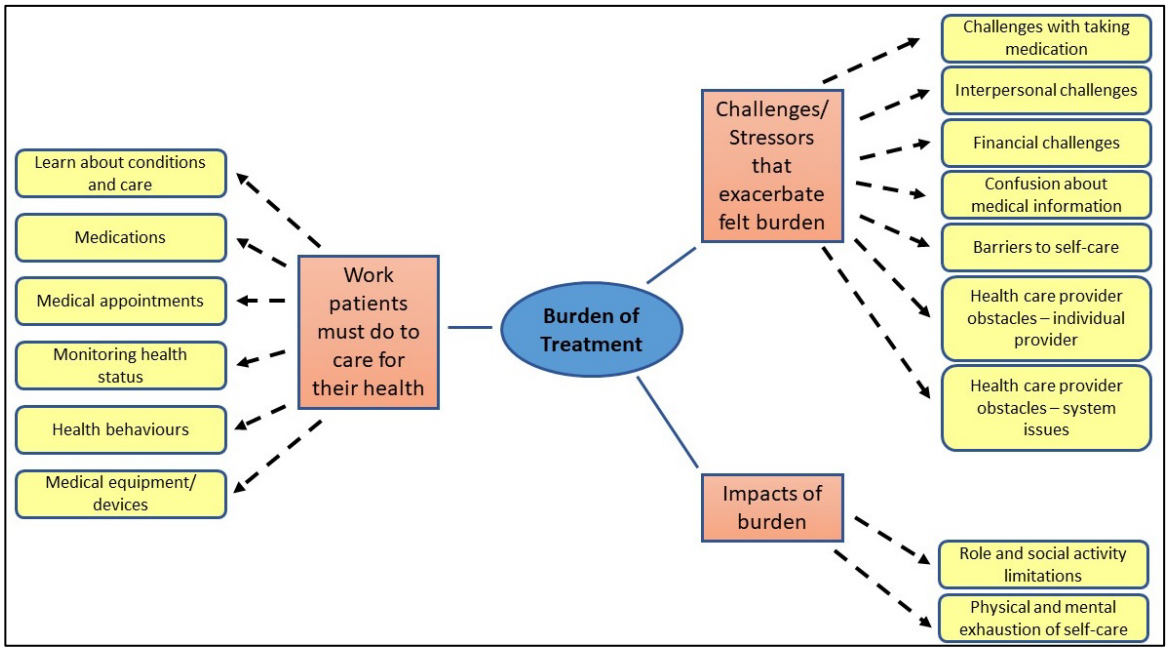


Figure 7: Eton's framework of treatment burden(74)

Eton's final framework showed reasonable overlap with 12 common domains of treatment burden identified by a systematic review (N=98) of patient-reported measures (N=57) in diabetes, chronic kidney disease, and heart failure(94). These domains are treatment convenience, self-care convenience, monitoring burden, diet/food-related issues, medical device bother, medication side-effects, family conflict, economic burden, scheduling flexibility, lifestyle impact, emotional/regimen distress and overall treatment burden. However, the majority of the studies (82%) in the systematic review were related to aspects of treatment burden in diabetes, a LTC which affects both children and adults and requires specific management with devices such as insulin pens or insulin pumps in diabetes which may not be relevant to other LTCs(94).

1.6.3 Sav's concept analysis of treatment burden

A systematic review and concept analysis by Sav et al (see Figure 8, page 50) described findings similar to Eton et al's framework(95). They proposed that predisposing factors such as patient characteristics, disease conditions, treatment options, family support, and engagement with healthcare systems all contribute to the treatment burden for LTCs(95). Dimensions or attributes of treatment burden include treatment side-effects, financial burden, time burden and personal burden. Sav et al described the dynamic and cyclic nature of treatment burden and suggest that the perception of burden can vary throughout the course of the disease, depending on the disease severity and impact. The dynamic nature of treatment burden means that the capacity to cope with numerous and changing treatment regimens may also vary. They defined treatment burden as "a person's subjective and objective overall estimation of the dynamic and multidimensional burden that their treatment regimen for chronic illness has imposed on them and their family members"(95). From their findings, they constructed a framework of treatment burden that comprises the antecedents (predisposing factors), attributes and consequences.

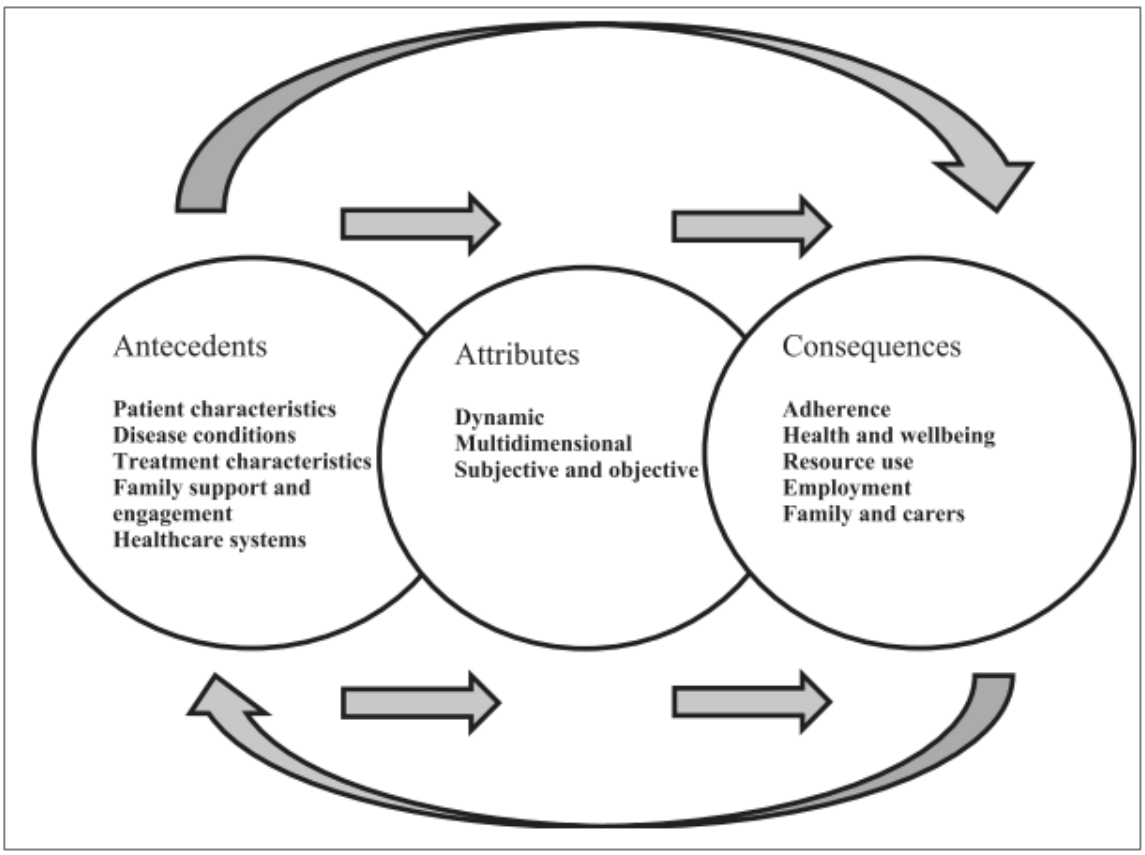


Figure 8: Concept Analysis of Treatment Burden(95)

1.6.4 Definitions of Treatment Burden

The ongoing progression and development of the treatment burden concept have led to several definitions of treatment burden. A recent systematic literature review published in 2020 by Alsadah et al found 16 different definitions of treatment burden, highlighting the breadth of the concept and the lack of recognised definition by all stakeholders(92). The review aimed to identify a definition of treatment burden that is applicable in clinical practice for multiple diseases and includes the main themes of treatment burden such as the work patients must do and factors that exacerbate the burden. The authors constructed their own criteria to evaluate the definitions of treatment burden, with two reviewers giving a rating out of six points according to: 1) usability in multiple diseases, 2) well-articulated and concise, 3) inclusion of main domains of treatment burden, 4) applicability in clinical practice, 5) differs from other types of burden such as caregiver or disease burden, and 6) based on patients' participation. Using these criteria for quality appraisal, they concluded that Boyd et al's definition of treatment burden, "patient's perception of the aggregate weight of the actions and resources they devote to their healthcare, including

difficulty, time and out-of-pocket costs dedicated to the healthcare tasks such as adhering to medication, dietary recommendations, and self-monitoring" was the most highly scored. However, the authors acknowledged that Boyd's definition was not evaluated by patients' participation and also contains the main domains of Eton's framework of treatment burden that was described above (see Figure 7, page 48). Therefore, **Eton's definition and framework of treatment burden** was chosen in this thesis as it is easily understandable and includes a broader notion of treatment burden compared to Boyd's definition. Furthermore, it was created following interviews and focus groups with patients with multimorbidity and therefore potentially suitable for use in PwP who may be considered an exemplar for multimorbidity.

1.6.5 Important Components of Treatment Burden

Despite growing research, treatment burden remains a developing concept with multiple different components and factors that interact with each other(96, 97). Rosbach et al identified six components of treatment burden in adults with multimorbidity: 1) interaction with the healthcare system, 2) medication burden, 3) lifestyle changes, 4) financial burden, 5) learning about conditions, treatments and navigating the healthcare system, and 6) others including self-monitoring or relationship with friends and family(96). Demain et al proposed that treatment burden of patients with any LTC across all ages (including children) is experienced as biological, biographical and relational disruptions(81). They concluded that sociological disruptions of treatment burden on everyday life and activities, personal identity and social aspects contribute towards the perceived workload of treatment. A recent scoping literature review by Sav et al has also suggested personal identity such as gender, age or culture differences is a fundamental component of treatment burden that may explain the subjective nature of treatment burden although this has not been widely explored(97).

The treatment burden experienced can differ between healthcare systems(75, 91). There are structural factors of healthcare systems that exacerbate treatment burden such as access to resources, care coordination between healthcare providers or availability of parking near healthcare facilities depending on the healthcare system in each country of residence(85). A large qualitative study (N=97) across four regions in Australia highlighted that the travel burden was found to be the most problematic for patients who lived in rural and remote areas of Australia as healthcare specialists were located in metropolitan areas(98). Financial burden irrespective of background and LTC was also a significant burden due to the high cost of treatment and consultations, the need for private health insurance and loss of income due to time taken off work for patients living in countries such as Australia and USA(86, 98, 99). Although financial

burden may not be applicable in the UK due to the NHS, it is worth considering other wider societal costs for families and informal carers including time and money, equipment or transport(80). Research by Parkinson's UK found that households with someone with PD in the UK typically spent £16,682 due to additional health costs such as pill-timers, mobility aids, parking charges for health appointments, social care costs with assistance for daily tasks and equipment, loss of income resulting from early retirement or reduced working hours due to PD progression(100).

Qualitative studies in the UK have explored the treatment burden experienced by patients with chronic heart failure and stroke using the Normalisation Process Theory as a framework to understand the work of enacting the treatment burden(77, 101). The Normalisation Process Theory seeks to understand the implementation, embedding and integration of tasks into everyday life(102). Four similar themes of treatment burden were identified in both patients with heart failure and stroke: 1) learning about treatments and consequences 2) engaging with others 3) adhering to treatment and lifestyle changes and 4) monitoring their treatments. They found that the treatment burden was affected by changes in service provision. For example, patients with stroke found that a change from care environments such as hospitals and rehabilitation centres to home and community-based services was challenging. Poor coordination, communication and deficiencies of care provided between services added to the treatment burden experienced by patients with chronic heart failure and stroke(101). Hence, treatment burden is not just affected by the nature of the illness, but also affected by the micro- and macro-organisations of healthcare services(77, 86, 101).

The treatment burden experienced varies between different conditions. For example, a qualitative systematic review explored the experiences of patients and informal caregivers' experiences of treatment burden in lung cancer and COPD and found significant differences in the treatment burden experienced(103). Treatment in patients with lung cancer may be seen as 'hope' by them and their caregivers, with a reluctance to stop treatment. Furthermore, the availability of immediate access and structured cancer treatment pathways for patients with lung cancer minimised the treatment workload. In contrast, patients with COPD experienced delays in accessing care and fragmented healthcare services due to a lack of clear COPD treatment pathways(103). Other patients with COPD also reported that smoking cessation is often challenging and can lead to emotional distress such as anxiety, frustration and low mood(104).

In summary, treatment burden is affected by personal, physical, mental, social, and healthcare-related factors which all interact with each other. Common attributes that contribute to components of treatment burden in LTCs from current evidence include medication and

treatment effects, availability of information, learning about health and treatment, healthcare-related aspects such as time and travel, scheduling appointments or fragmented care, financial burden, availability of social networks, issues due to their underlying health condition and the need for self-care and self-monitoring. These fundamental components of treatment burden are applicable across patients with a specific LTC or multimorbidity although there are variations across healthcare systems and conditions.

1.7 Concepts of Patient Capacity

Patient capacity can be described as the ability and willingness to access and utilise available resources to address the workload of health and the demands of everyday life(75, 76, 105). This is a distinct concept from mental capacity, which is the ability of someone to make their own informed decisions. The Cumulative Complexity Model described earlier in the chapter explores how the treatment burden is balanced by patient capacity(76). Patient capacity is a dynamic concept, which varies depending on the disease and patient life trajectory(83). It is affected not only by limitations from reduced mental and physical functioning or symptoms of their illness such as pain or fatigue but also affected by the lack of available socioeconomic resources, psychological resources, health literacy, language and social support(76). Patients who cannot manage the workload of healthcare and life may not be able to fully access and use healthcare, even if the resources are available to them. Despite the importance of recognising patient capacity to manage the workload of healthcare, a mixed-method study concluded that medical records scarcely document conversations that address patient capacity(106). Physical capacity was most documented in medical records, whereas other important domains of capacity such as financial and environmental capacity were barely mentioned(106).

Boehmer et al proposed the '**Theory of Patient Capacity'** and used the acronym 'BREWS' to summarise the key constructs that influence patient capacity. Patient capacity is a complex phenomenon and is accomplished following multiple interactions of one's Biography, Resources, Environment, Work (realisation of), and Social constructs that either limit or enhance capacity. The authors explored patient capacity by conducting a large qualitative systematic review (N=110) and synthesised patients' views and experiences of capacity from studies conducted across 10 countries(105). The review included qualitative studies of patients with any LTC that described capacity limitations or barriers to accessing healthcare or enacting self-care. Importantly, they reported that patient capacity can be improved and that patients are not only able to survive and cope with healthcare tasks but are also able to complete the workload of healthcare without

compromising their priorities and happiness(105). These findings also support the Burden of Treatment Theory that posits that patient capacity relies on their ability to mobilise capacity depending on the social skills and social networks within their social settings(75).

1.7.1 Aspects of Patient Capacity

Leppin et al described patient capacity as "the sum total of resources and abilities that a patient can draw on to access care, use care, and enact self-care"(83). Based on clinical and research experience, they proposed that six domains of capacity are: 1) physical, 2) mental, 3) social, 4) financial, 5) personal and 6) environmental. Physical and mental capacity may be limited by the disease itself or treatment (such as medication side-effects). The other four domains (social, financial, personal, and environmental) depend on individual circumstances such as relationships with family and friends, employment status, personal resilience, and where they live. Ridgeway et al reported findings from interviews with patients with one or more LTC (N=50) and described the five themes that lessen the treatment burden as: 1) problem-focused strategies, 2) emotion-focused coping strategies, 3) questioning the notion of burden, 4) social support and 5) positive aspects of healthcare(93). These themes could also be construed as factors that influence patient capacity. They described how the individual provider (good communication and patient-provider relationship) and systemic (well-coordinated healthcare system) aspects of the healthcare system can reduce the treatment burden experienced. Furthermore, social networks were key in helping patients with heart failure adhere to medication, maintain a good diet and exercise, and provide emotional support(107). Patient capacity also relies on personal characteristics such as inherent personal strength and maintaining a positive attitude as well as coping strategies including selective denial, adaptation by setting new goals in lives, and choosing what information they wish to learn about heart failure(107).

Hounkpatin et al conducted interviews in the UK with 29 older patients (mean age=75 years) with chronic kidney disease followed by a focus group with members of the multi-professional kidney team to explore the factors that support patient capacity to manage the treatment burden(108). Financial capacity was reported as an important component of patient capacity as well as personal attributes and the ability of support networks such as emotional and practical support from their family and friends(108). Patients described that the financial impact of paying for private care due to long waiting times in the NHS, costs of equipment to help manage their health and costs of travel to appointments was exacerbated by the loss of employment and limited financial benefits. Attending appointments relied on whether patients owned a car or whether they were able to pay for transport to appointments. Proximity to hospitals and availability of

patient transport services helped with the travel costs of attending appointments. Members of the kidney team interviewed acknowledged that financial difficulties were exacerbated by the treatment burden of attending appointments, symptom burden and strict dietary requirements in chronic kidney disease.

Other quantitative studies have also explored aspects of patient capacity and how this may influence the treatment burden. For example, Schreiner et al reported the association between the symptoms of LTCs and treatment burden levels in older adults with multimorbidity (mean age=75 years)(109). Controlling for the number of LTCs, they found that high levels of fatigue strongly predicted higher treatment burden levels, although having a caregiver reduced the levels of fatigue and treatment burden levels(109). Higher levels of fatigue have also been reported to be a risk factor for higher treatment burden levels in patients living with human immunodeficiency virus (HIV)(110). In patients with tuberculosis, fatigue was reported as a medication side-effect which required them to change their treatment regimen as well as change the schedules of their daily routine in order to accommodate for times when they felt fatigued(111). Health literacy is also an important aspect of patient capacity that impacts treatment burden(76). A population-based study of patients with cardiovascular disease in Denmark reported that low health literacy or difficulty understanding health information was associated with high treatment burden levels(112). The association of low health literacy and high treatment burden has also been reported in a cross-sectional study of older adults with multimorbidity in the UK(113).

Therefore, physical or mental ability related to underlying health as well as other personal, financial, and social factors can impact one's ability to manage their health. Patient capacity is not static and interacts closely with treatment burden. Patients and caregivers may experience treatment burden due to the overwhelming workload of health or reduced capacity, which can lead to poor outcomes as previously described.

1.8 Measurements of Treatment Burden

The first step towards reducing the treatment burden is to accurately and efficiently assess treatment burdens in clinical practice(73, 91). However, no universal measure has been used in routine clinical practice(84). Several measures to assess treatment burden have been developed and validated in patients with LTCs. These measures will be described in this section. Although aspects of patient capacity have been explored, no tool or measure of patient capacity has been developed to date.

1.8.1 Treatment Burden Questionnaire

The Treatment Burden Questionnaire (TBQ) was initially developed in French following a literature review and qualitative semi-structured interviews with patients with various LTCs (N=502, mean age=59 years) such as diabetes, rheumatological diseases and high blood pressure(114). The TBQ included burden associated with medication intake, self-monitoring, laboratory tests, healthcare appointments, the need for organisation and administrative tasks, following advice on lifestyle changes (diet and physical activity) and the impact of treatment on social relationships(114). This was then translated into English and developed further(86, 114). Participants were recruited using a pre-existing online network for voluntary participants with at least one LTC to share data about their treatment, conditions and symptoms. Participants joined the site with the expectation that they would be participating in research which may have led to a response bias. The final 15-item English version included financial burden and burden associated with the difficulties in patients' and healthcare-providers relationships. Each item on the TBQ is rated from 0-10, with a total score of 150. This was validated in patients across multiple English-speaking countries (USA, Canada, UK, Australia and New Zealand) with different conditions and treatments who had access to a computer and were computer-literate(86). Patients were also younger (N=610, mean age=52) and more educated (only 4% with less than high school level education) compared to the general population with multimorbidity. Furthermore, there were more female patients (78%) in this study. Therefore, the use of the TBQ may be less generalizable to older people with a higher prevalence of multimorbidity(37).

The French version of the TBQ was also adapted into English by Sav et al with the addition of two questions measuring financial burden and treatment side-effects(79). The cross-sectional study included participants (N=581, mean age=57) who had one or more LTC or was a caregiver for someone with a LTC with or without a LTC themselves. Data collection occurred across four Australian regions including rural, semi-rural and metropolitan areas via telephone or face-to-face, with participants offered a supermarket gift voucher as reimbursement. They identified that younger patients with multimorbidity and those who have an unpaid caregiver may be at risk of treatment burden. The TBQ has also been used to measure the treatment burden of people living with HIV in the USA and determine the factors associated with high treatment burden levels such as higher number of LTCs and lower social capital(110, 115, 116).

1.8.2 The Patient Experience of Treatment Burden and Self-Management

The Patient Experience of Treatment Burden and Self-Management (PETS) version 1.0 was developed in the USA using Eton et al's framework for treatment burden(87). Participants were recruited from two different clinical sites in the USA, to ensure the inclusion of a diverse range of participants with two or more chronic conditions (N=332, mean age=66 years)(87). The 48-item measure includes nine domains of treatment burden: medical information, medications, medical appointments, monitoring health, interpersonal challenges, medical and healthcare expenses, difficulty with healthcare services, role and social activity limitations and physical and mental exhaustion. Each item referenced a recall period of the past four weeks and used 4- or 5-point ordered categorical response scales. The PETS version 1.0 has also been validated in people diagnosed with type 1 or type 2 diabetes who also had at least one other LTC(117).

PETS version 2.0 is a 60-item measure with the addition of a further three domains of treatment burden: diet, exercise/physical therapy, and medical equipment, and the addition of three modified items to the medical appointment domain(118). Although the PETS is a comprehensive measure of treatment burden, the length of the questionnaire may be a limitation for use in routine daily clinical practice(80, 97). Realising this limitation, a shorter version entitled the Brief PETS consisting of 32 items was developed(119). To achieve this, the authors conducted interviews with patients with multimorbidity (N=30) and a survey of healthcare providers (N=30) to determine the most important issues about managing health that a healthcare provider should know about. The Brief PETS was then validated in a prospective study of 400 patients (mean age=58) with multimorbidity. They found that the use of Brief PETS was feasible and acceptable with 91% of participants willing to complete the measure as part of their regular visits with healthcare providers.

1.8.3 Multimorbidity Treatment Burden Questionnaire

In the UK, Duncan et al developed the Multimorbidity Treatment Burden Questionnaire (MTBQ) to assess treatment burden in patients with multimorbidity (three or more LTCs)(80). Questions were derived following a literature review and pertinent domains of treatment burden from three patient-related outcome measures that were not disease-specific: 1) TBQ, 2) The Multimorbidity Illness Perceptions Scales (MULTIPLEs), and 3) Healthcare Task Difficulty (HCTD) questionnaire(80). This was reviewed against the three main themes from Eton et al's framework of treatment burden. They engaged a patient and public involvement (PPI) group of eight patients

with multimorbidity before finalising the questionnaire. The MTBQ includes burdens associated with taking multiple medications, self-monitoring, lifestyle changes, obtaining information about their condition, coordinating healthcare and the impact on family and friends. The final MTBQ consists of 10 items and fits onto one A4 sheet of paper, making it accessible and user-friendly. This was validated in a large population of older adults with multimorbidity (N=1546, mean age=71 years) who were recruited from UK primary care(80). Three items that measure financial burden, access to healthcare out of hours, and access to community services were excluded due to a high proportion of 'does not apply' responses in this population(80). However, the 13-item questionnaire could be relevant to other populations. The MTBQ has the potential for use in everyday clinical practice, although further work is required to validate its use in a clinical setting(80, 84).

1.8.4 Single-item Treatment Burden Measure

Morris et al conducted a cross-sectional postal survey of older adults with multimorbidity (N=835) to determine associations of high treatment burden using the MTBQ and explored the use of a novel single-item treatment burden measure(113). The exploratory single-item measure was phrased as: *"On a scale of 0-10, where 0 is no effort and 10 is the highest effort you can imagine, how would you rate the amount of effort you have to put in to manage your health conditions?"*. Participants were required to circle their response along a number-line scale. Although not subject to formal development, they found that the single-item treatment burden measure was potentially useful in ruling out patients with high treatment burden in a general multimorbid population, not specifically those with PD (sensitivity = 89%, specificity = 58%, positive predictive value = 31%, and negative predictive value = 96%). The single-item measure has since been further developed by the same research team with input from a single PPI group workshop followed by iteration and refinement of the final question via email to: *"Have you felt overstretched by everything you've had to do to manage your health in the last month (e.g. taking medications, getting prescriptions, attending appointments)?"*(120). This measure is being explored further in a follow-up cross-sectional survey of participants in Dorset who took part in the initial baseline survey.

1.9 Caregiver Treatment Burden

Caregiver treatment burden is the workload of healthcare that caregivers have to manage when supporting someone with a LTC. This may include helping the person they care for with taking

medications, attending healthcare appointments, or monitoring their health. Recognising caregiver treatment burden is important as support from social networks may increase patient capacity and reduce the treatment burden experienced(75). Caregivers have a vital role as part of patients' social networks as they help support the activities of daily living as well as help to address, treat and monitor the health of patients with LTCs or multimorbidity(66, 84). Equally, social networks may have an important role in providing support for caregivers themselves(121). Although caregiver treatment burden is a separate concept that relates to the experiences of managing the workload of healthcare, caregiver treatment burden may be closely interlinked with caregiver burden, a term which was described earlier in this chapter (see Section 1.4, page 41).

Nevertheless, a recent systematic review by Sheehan et al in 2019 found only six studies have assessed caregiver treatment burden(84). It is worth noting that the review only included studies with the term 'treatment burden' which remains a new concept in the literature. This may have led to the exclusion of other studies involving caregivers of people with LTCs that reported on aspects of treatment burden, even where the term 'treatment burden' is not specifically used. Lippiett et al conducted a systematic review of qualitative studies (N=127) to explore the experiences of treatment burden for patients and caregivers with lung cancer and COPD(103). They reported that caregivers of patients with lung cancer prioritised supporting the workload of healthcare of the person they care for over the demands of everyday life, recognising the gravity of a potentially life-threatening diagnosis. Caregivers of patients with COPD instead reported the increasing accumulation of treatment burden as the progressive disease led to the functional deterioration of the person with COPD. Two studies conducted in Australia described the caregiver treatment burden of patients without a specific condition but had at least one LTC such as diabetes, cardiovascular disease or cancer(98, 122). As described in the previous section, Sav et al conducted interviews with caregivers and reported the four components of treatment burden in patients and caregivers as: 1) financial burden, 2) medication burden, 3) time and travel burden, and 4) healthcare access burden(98). The same research team conducted interviews with senior representatives (N=15) from Australian Consumer Health Organisations that promote and represent the interests of healthcare users and caregivers with a chronic illness(122). They described how the impact of treatment burden on caregivers caused distress and frustration, and led to caregivers neglecting their own life and needs, including their health and well-being. This was exacerbated as some caregivers also had LTCs that they had to manage, as well as poor relationships with healthcare professionals and poor support from the healthcare system(122).

No specific tools to measure caregiver treatment burden have been validated. However, the TBQ has been used in caregivers of people with LTCs(79). However, aspects of caregiver treatment burden have been described in caregivers of older adults in other quantitative studies(123, 124).

Giovannetti et al conducted a cross-sectional survey with caregivers (N=308, mean age=79 years) of patient LTCs using the Healthcare Task Difficulty (HCTD) scale(123). The HCTD consists of eight healthcare tasks including obtaining medication, planning medication schedules, administering medication, deciding to change medication, managing medical bills, scheduling medical appointments, arranging transportation, and getting information. Caregivers were asked if they assisted the patient with a task and if so, measured the difficulty of completing each task. The majority of caregivers (80%) helped obtain medications, whilst the most difficult tasks reported by caregivers were helping to follow a recommended diet, arranging transportation, and monitoring patients' health. Wolff et al conducted a large population-based national survey of older adults in the USA (N=23.2 million; aged >65 years) with LTCs which included questions related to the aspects of treatment burden such as managing medicines, getting tests and lab work done, monitoring weight and blood pressure, or having yearly exams(124). The survey found that 20% (6.6 million) managed their health together with family and friends (co-manage) whilst another 11% (3.7 million) delegated their healthcare activities to family or close friends. Results from the survey found that those who co-managed and delegated healthcare activities had more treatment burden compared to those who managed their health independently(124). Although this study obtained perspectives from older adults themselves and not their family or friends (caregivers), a substantial number of older adults with chronic conditions rely on informal caregivers to manage their health, highlighting the importance of recognising caregiver treatment burden.

1.10 Treatment Burden and Capacity in Parkinson's Disease

Management of PD predominantly relies on oral medications, which may be a significant aspect of treatment burden in PwP. A Scottish cohort study of patients in primary care reported that in their sample of PD patients (N=2640, aged >55 years), 19% were prescribed ten or more medications compared to 6% of people without PD(41). As PD progresses, the number of medications for PD increases. A survey of 500 patients from across the USA and five European countries (France, Germany, Italy, Spain and the UK) found that early-stage PD patients take a mean of three tablets daily of PD medications, rising to 10 and eight tablets for patients with advanced-stage PD in the USA and Europe respectively(125). This number only refers to PD medications. PwP who also have other LTCs may have to manage higher number of medications that may interact with each other(34). Despite the importance of pharmacological treatment in PD to achieve symptom control, suboptimal medication compliance is a common issue with various contributing factors(126-128). For example, a multicentre study in five European countries (France, Germany, Italy, Spain and UK) in PwP (N =112) reported that PD medication omissions

were common, as 21% of patients missed at least one antiparkinsonian medication on one day, whilst 12% missed medications on two consecutive days and 5% missed medications on three consecutive days(129). Poor medication adherence was significantly associated with poor motor scores, poor "off" time and worse mobility. Clinical factors associated with medication non-adherence were depression, impaired cognition, poor symptom control or reported QoL, younger age or longer duration of PD, multiple daily dosing schedules, medication regimen complexity, polypharmacy, frequent dose changes and risk-taking behaviour(130, 131). Demographic factors associated with medication non-adherence in PD were higher education levels and poor knowledge of PD, lack of spouse or partner, lower income, maintaining employment and gender(131). These factors may perhaps also be important aspects of patient and caregiver capacity that influence how they manage the treatment burden associated with PD.

Other than medications, attending healthcare appointments and issues obtaining information may also be important aspects of treatment burden in PD. A UK national survey conducted in the UK with PwP (N=776) and their caregivers (N=546) aimed to evaluate the economic and social costs of PD(100). The survey results reported that PwP had an average of 22 consultations with various healthcare professionals and an average of three diagnostic tests in one year. This reflects the very high usage and cost of healthcare services required to manage PD(100). The Parkinson's UK national audit in 2019 of PwP and their caregivers (N=8247) reported that 31% of PwP and caregivers reported that they were not given enough information when starting new PD medications including information about potential medication side-effects(63). Furthermore, 26% of participants felt that they were not given information on how to access Parkinson's UK support services.

The prevalence of frailty and multimorbidity in PD leads to clinical complexity and increases the risk of adverse outcomes in PwP(34). This may also impact both treatment burden and capacity of PwP and their caregivers. In 2020, Tenison and Henderson described the substantial impact of medications burden on PwP who may already have reduced reserve due to their underlying condition. They described the burden of polypharmacy, anticholinergic effects, adverse drug reactions, and the increased risk of drug-drug and drug-disease interactions(34). This may potentially increase the medication burden in PD. For example, clinicians may diagnose medication side-effects as a new condition and introduce a new medication rather than review prescribed medications leading to a prescribing cascade and worsening polypharmacy(34). This can lead to falls and fractures in PwP which consequently lead to hospitalisation, increased risk of delirium, poor motor symptoms control, deconditioning, disability and subsequently mortality(34).

The inevitable progression and consequent complexity of PD often require PwP and their caregiver to receive long-term input from a MDT consisting of various healthcare services. Unfortunately, current healthcare systems for chronic neurological conditions may be fragmented, with poor coordination between services and a lack of timely access to specialist services and therapies(50). This may vary widely between different healthcare settings and countries. In the UK, a study conducted interviews with a purposive sample of PwP (N=10, mean length since diagnosis of PD = 18 years) to understand the experiences of service use and unmet care needs of those with late-stage PD with high degrees of disability(132). Participants described a particular challenge of healthcare as the lack of coordination and continuity of care for the multiple symptoms and comorbidities with PD. They also experienced inflexible care structures when admitted to the hospital where their timings of PD drug administration were dictated by ward routines rather than their usual medication routine. This study found that the perceived needs of PwP were only partially met by the current organisational structures of health and social care provision in the UK. Therefore, current healthcare systems may potentially contribute to the treatment burden and capacity experienced by PwP and caregivers.

1.10.1 Gaps in Current Knowledge

Although there has been increased awareness of treatment burden in LTCs, no studies have specifically explored the treatment burden and capacity in PwP and their caregivers. PwP are a group of patients with complexity, multimorbidity and frailty. This may put them at increased risk of experiencing high treatment burden and consequently poor health outcomes, poor QoL and fragmented healthcare. Studies in other LTCs described in this chapter have highlighted that there are potential strategies that can reduce the treatment burden or enhance patient capacity. Given the predicted increase in numbers of PwP with the ageing population and the impact of PD on health and social care demands, research on this topic is urgently needed to prevent poor outcomes.

Some PwP may be able to manage the treatment burden independently without the help of a family member or friend. However, others may rely on their family or friends to help manage the treatment burden. Patients' capacity to manage the treatment burden may therefore be reliant on their caregiver, particularly due to the progressive impact of PD on their physical and mental ability. Caregivers of PwP may potentially also experience high treatment burden as they jointly help to manage the workload of PD whilst navigating fragmented healthcare systems(133). Caregivers themselves may have treatment burden associated with their own LTC as well as reduced capacity to manage not only their own health but also the person with PD. Therefore,

caregiver treatment burden and caregiver capacity may potentially impact on both the patient treatment burden and patient capacity for the person with PD. This hypothetical interlinked relationship between the treatment burden and capacity of PwP and their caregivers is shown in Figure 9.

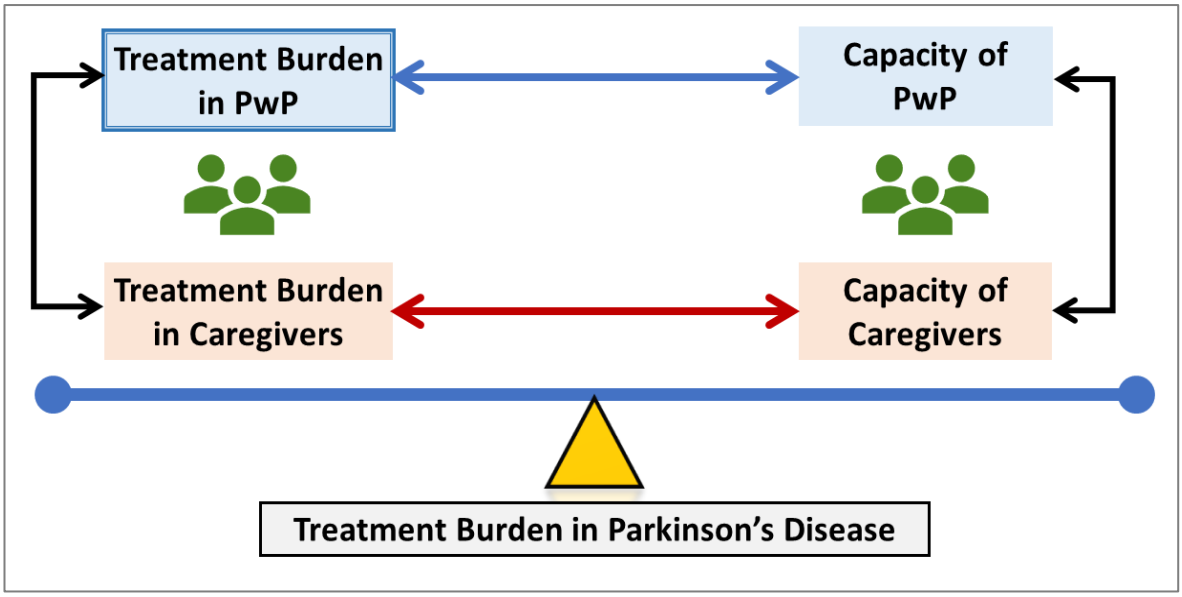


Figure 9: Hypothetical Relationship of Treatment Burden and Capacity in People with Parkinson's and Caregivers

1.11 Aims and Objectives of PhD study

This research study aims to identify the key factors that influence the experiences of treatment burden and capacity in PwP and their caregivers.

The study objectives are:

- To explore modifiable factors that impact treatment burden and capacity of PwP and their caregivers
- Identify the impact of multimorbidity and frailty on treatment burden in PwP and their caregivers
- Develop recommendations of ways to improve the treatment burden and capacity among PwP and their caregivers
- Disseminate the study findings and prioritise recommendations for change

The following chapters of this thesis will discuss the four Work Packages and methods used in this study to achieve the aims and objectives above, starting with a systematic review of treatment burden in PD followed by a mixed-methods study to obtain the views and experiences of PwP and their caregivers through interviews, a national survey and focus groups.

Chapter 2 Methodology

2.1 Introduction to Chapter

This chapter aims to discuss the methodological considerations for this study titled 'The PD Life Study', including the potential strengths and weaknesses of the chosen methods. This was an exploratory study using a mixed-methods approach, conducted over four Work Packages (see Figure 10, page 66). Each Work Package is built on the findings from the previous Work Package to achieve the overall aim of this study. The four Work Packages were:

- **Work Package 1:** A systematic review and synthesis of qualitative studies using framework synthesis informed by Eton's framework to explore the experiences of treatment burden among PwP and their caregivers.
- **Work Package 2:** A qualitative study using semi-structured interviews with PwP and caregivers in Southampton and Dorset, building on findings from Work Package 1 to gain a deeper understanding of their experiences and views of the modifiable factors that impact their treatment burden and capacity.
- **Work Package 3:** A cross-sectional national survey for PwP and caregivers which built on findings from Work Packages 1 and 2 was conducted to measure treatment burden levels using the Multimorbidity Treatment Burden Questionnaire (MTBQ). The survey identified factors and aspects of patient capacity associated with treatment burden levels (MTBQ scores).
- **Work Package 4**: Focus group discussions with multiple stakeholders were then held to discuss the overall integrated findings from Work Packages 1-3 and to develop recommendations of ways to improve the treatment burden and capacity among PwP and their caregivers.

The next section in this chapter will first describe the patient and public involvement (PPI) and the ethical approvals obtained. I will then provide a brief overview of paradigmatic differences in research methods, my role as a researcher and my approach to the study. Finally, I will briefly describe qualitative, quantitative and mixed-method research methods before discussing the methodological considerations for each of the four Work Packages in order.

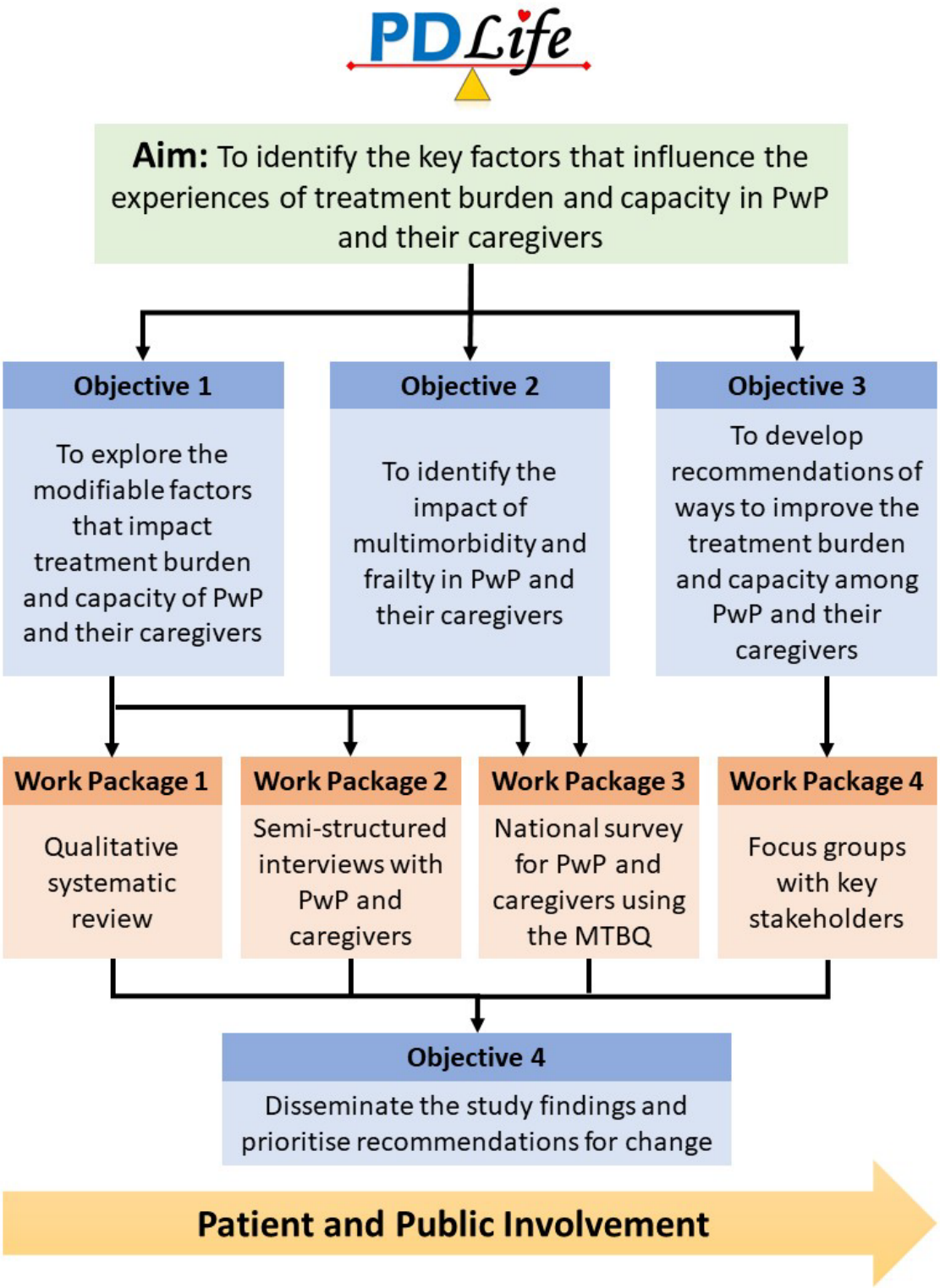


Figure 10: The PD Life Study Methods

2.2 Patient and Public Involvement

This study involved a patient and public involvement (PPI) group throughout the study with support from the National Institute for Health and Care Research (NIHR) Applied Research Collaboration (ARC) Wessex PPI champion, who was a female caregiver of someone with dementia and a second PPI member who was a female caregiver of someone with PD. They were involved with the initial planning of the research proposal and study design, grant writing applications, review of the study protocol, lay summary, and all patient-facing documents. Their input led to additional questions in the interview schedules and surveys to ensure that we capture all aspects of treatment burden and capacity, such as access to technology and the impact of PD on employment for the person with PD and caregiver. They recommended changes to the survey questions such as the removal, rewording and change in the order of questions to reduce the burden on participants and enable ease of understanding. For example, questions about financial ability such as whether respondents received attendance or carer allowance were removed from the survey as one PPI member felt this was too intrusive. Furthermore, a free-text section to capture other long-term conditions of survey participants, and a question for caregivers on whether they had given up employment to care for the person with PD were included in the surveys based on PPI recommendation. The interviews and national surveys were then scrutinised and piloted with two patients with PD, and one caregiver with PD to check the acceptability and understanding of questions as well as ensure that they were not burdensome to participants. This led to additional questions on the survey including the impact of PD stopping the person with PD from driving and the use of prescription delivery services for medications.

2.3 Ethical Approvals

The PD Life Study gained ethical approval from the West Midlands Coventry & Warwickshire NHS Research Ethics Committee and Health Research Authority (REC 21/WM/0058), and the University of Southampton Ethics and Research Governance (ERGO 62623) in March 2021. An amendment was requested after questions were added to the national survey following the interviews, and the finalisation of the focus group guide based on the main issues of treatment burden identified from Work Packages 1-3. The study protocol was amended to include the distribution of a one-page summary of the key issues of treatment burden and capacity to focus group participants to generate discussion about ways to improve these. The approvals can be seen in Appendix A (page 305). All required licenses and approval for use of validated measures were obtained before the study.

2.4 Research Paradigms

According to Thomas Kuhn, an American philosopher of science, a research paradigm is “a set of commonly held beliefs and agreements shared between scientists about how problems should be understood and addressed”(134). It is the conceptual lens through which the researcher examines the methodological aspects of their research study to determine what should be studied, how it should be studied, and how the study results should be interpreted(135). They define the researcher’s philosophical orientation and thus have an important significance for every decision made during the research process, including the choice of methodology and methods(135). Qualitative, quantitative, and mixed-methods research have different research paradigms which are described briefly next.

2.4.1 Qualitative, Quantitative and Mixed-Methods Research Paradigms

The **qualitative paradigm** is based on **constructivists**(135, 136). Ontologically speaking, this means there is no single reality or truth, but instead multiple subjective realities or truths that co-exist based on one’s construction. Reality is socially constructed, constantly changing and subjective based on one’s perspective and personal experiences. Therefore, reality needs to be interpreted. In this paradigm, the theory does not precede research but rather follows it so that is grounded from the data generated(135). Therefore, qualitative methods have an inductive approach and seek to generate new theories emerging from the data, using context-specific exploratory research methods. The aim is usually focused on exploring new phenomena or previously researched phenomena from a different perspective, with an emphasis placed on understanding the individual perspective and their interpretation of the world around them(135).

The **quantitative paradigm** is based on **positivism**(135, 136)**.** Compared to constructivists and interpretivists, positivists hold the belief that science is characterised by empirical research and that all phenomena can be reduced to empirical indicators which represent the truth. The ontological position behind positivism is that there is only one truth and an objective reality that exists independent of human perception. This means that reality can be measured and that the production of knowledge is replicable and thus able to be tried and tested. This aligns with quantitative methods of research with a focus on reliable and valid tools. A deductive approach is undertaken where the ‘top-down’ method is used relying on the formulation and testing of a hypothesis or theory(135). It is used to test the cause and effect of relationships within the data, using context-free methods.

The extent to which qualitative and quantitative research differ from one another has long been a subject of debate, with each approach seen to belong to distinctively different research paradigms, although this is not necessarily static(137). However, both qualitative and quantitative research is important and can be used to complement each other. **Mixed-method research** is grounded in **pragmatism**(136, 138)**.** Pragmatists believe that reality is constantly renegotiated, debated and interpreted in light of its usefulness in new unpredictable situations. A pragmatic perspective uses diverse approaches giving importance to the research question and problem and values both objective and subjective knowledge(139). Therefore, research methods can be mixed in ways to offer the best approach to answer a research question or solve a problem, regardless of any assumptions that can arise related to the particular situation(138).

2.4.2 My Role as a Researcher and Research Approach

I am a female specialist registrar in geriatric and general internal medicine in my early thirties who grew up in Malaysia. I moved to the UK in 2008 to attend medical school and have since continued my junior doctor training in the UK. My personal experiences with the social and cultural differences experienced living in Malaysia and the UK meant that I was aware that one's beliefs and behaviours can be subjective depending on their experiences and social context. This perhaps fits more with the constructivist paradigm.

Throughout undergraduate training in medical school and as a doctor, the positivist paradigm was a principal feature in healthcare research with a focus on the aetiology, prognosis and prevalence of health conditions which are commonly explored using quantitative research methods such as cohort or cross-sectional study designs(140). Furthermore, the effectiveness of medications or healthcare interventions are commonly studied using RCTs. My undergraduate medical training included a Bachelor of Medical Sciences integrated degree which introduced the core concepts of research including performing a literature search, critical appraisal, writing a literature review, the basis of qualitative and quantitative research methodology and various methods of data analysis. I also conducted a supervised research project evaluating investigations for growth hormone deficiency and associated secondary adrenal insufficiency in children. During my clinical training as a doctor, I also conducted multiple quality improvement projects and audits. These projects all involved quantitative research methods. I had no first-hand experience in conducting qualitative research methods. Therefore, I was perhaps more accustomed to the positivist paradigm.

Before starting my PhD, my NIHR Academic Clinical Fellowship research training meant that I was able to learn more about qualitative research during the early stages of development of the study

protocol by attending courses, webinars, and conducting self-study and discussions with other researchers and my supervisors. This enabled me to gain further awareness of the importance and relevance of qualitative research within healthcare research, and how exploring the user's perspectives of interactions, events and social processes can have positive or negative implications on their experiences with healthcare(140). My training as a geriatric specialist registrar also emphasised the importance of listening, exploring and understanding patients' and relatives wishes and priorities of care. Consequently, I found that the **pragmatic approach** was aligned with the conduct of this study.

2.5 Overview of Research Methods

This study used a mixed-methods approach, where both qualitative and quantitative data were collected and analysed within the same study. The following subsections will describe the methodological approach and considerations in qualitative, quantitative and mixed-methods research.

2.5.1 Qualitative Research

Qualitative research is an interpretative approach using both qualitative methods of data collection and qualitative methods of data analysis that seeks to discover the meanings individuals attribute to their experiences of the social world and how they make sense of that world(141). Qualitative research seeks to explore multiple phenomena of interest that involve behaviour or attribute meaning to behaviour. It can also be used to develop a new theory. In healthcare research, qualitative research has been used to understand the experiences of patients, caregivers, healthcare professionals, and other key stakeholders of a health condition or intervention within their social and cultural context(142). Qualitative research can also offer a variety of methods that can lead to an understanding of how to improve healthcare quality(143). For example, qualitative research can identify what matters to healthcare users, identify barriers to changing performance and explain why improvement does or does not happen. Qualitative research has numerous strengths and limitations, some of which are summarised in Table 4 (page 71)(141, 144).

Table 4: Strengths and Limitations of Qualitative Research

Strengths	Limitations
Allows detailed exploration of issues, the discovery of subtleties and complexities of research topics with an interpretative focus by questioning assumptions and common sense	The large volume of data can make data analysis and data interpretation more time-consuming, whilst the presentation of qualitative findings in a visual way can be more challenging
Obtains powerful data based on human experiences in their day-to-day settings that can be more captivating than quantitative data	The presence of the researcher during data collection may affect participants' responses and inhibit sharing of information
Potential flexibility with qualitative methods:- • Interview questions are not restricted to specific questions and may be redirected by the researcher in real-time • A combination of several different qualitative methods of data collection can provide deeper insights • The research framework and direction may be revised as new information emerges	Rigour may be more difficult to maintain assess and demonstrate compared to quantitative methods; although there are strategies to ensure issues of validity, reliability and generalisability can be assessed
Qualitative data tend to be collected from fewer participants which means findings may be transferable to another setting, but not generalised to a larger population	Heavily dependent on individual researcher skills or experiences and may be more easily influenced by personal biases

Qualitative research methods of data collection that are commonly used include interviews, focus groups, participant observations and analysis of documents(141-143). Each method is suitable for collecting a specific type of data based on the underlying research question or studied phenomenon (see Table 5, page 72).

Table 5: Qualitative research methods

Qualitative methods	Descriptions
Interviews	Involves asking participants a set of questions; Optimal for collecting data on individuals' personal histories, perspectives, and experiences, particularly when sensitive topics are being explored.
Focus Groups	Group interviews comprising individuals of certain characteristics to elicit data on the cultural norms of a group, generate broad overviews of issues of concern, develop ideas or validate recommendations within the group.
Observational Methods	The researcher takes notes on what is happening around them and observes naturally occurring behaviours in their usual context and setting, rather than relying on reported behaviour.
Documentary Analysis	A systematic procedure for reviewing and evaluating documents for examination and interpretation to elicit meaning, gain understanding and develop empirical knowledge.

In Work Package 2, **interviews** were chosen to explore the reasons and understand the experiences of treatment burden and capacity of PwP and caregivers, which had not been explored previously. **Focus groups** were chosen in Work Package 4, as it allows discussions between various stakeholders with different experiences involved in the care of PD to generate their views and recommendations of ways to improve the treatment burden and capacity among PwP and caregivers. These methods are described in further detail later in Section 2.7 (page 85) (interviews) and Section 2.9 (page 101)(focus groups). Both participant observation and analysis of documents methods of qualitative research do not enable deeper explorations and understandings of the experiences of PwP and caregiver from their perspectives and therefore were not chosen for use in this study.

2.5.2 Quantitative Research

Quantitative research focuses on objective measurements and the statistical, numerical analysis of data to describe and explain the phenomena of interest(145). This generates a numeric measure that yields data that can be counted, ranked, categorised, graphed or statistically analysed using a range of techniques and processes. Some of the advantages of conducting quantitative research are datasets are large with findings representative of a population that can be generalized to a specific population, documentation regarding the research framework and

methods can be shared, and the use of standardised approaches allows the study to be replicated (146, 147). However, limitations of quantitative research are that data does not provide evidence for why populations think, feel, or act in a certain way, specific demographic groups such as particularly vulnerable or disadvantaged groups may be difficult to reach, and studies can be time-consuming and require data collection over long periods(146).

Although by no means an exhaustive list, quantitative research study designs commonly used in healthcare research fall into two broad categories: 1) observational studies or 2) experimental studies(148, 149). These methods are briefly described in Table 6. A **cross-sectional national survey** was conducted in Work Package 2 of this study to determine the factors associated with treatment burden and capacity in PD. This is described further in Section 2.7.3 (page 89). Although a longitudinal cohort study would also be suitable, this was not practical within the resource constraints of this study.

Table 6: Commonly used quantitative research methods in healthcare research

Quantitative Study Designs	Methods	Description
Observational Studies:- *Studies where there is no intervention or attempt to alter the situation for any participant*	**Cross-sectional study**	Studies that explore a population at a single point of time and variables are recorded for each participant. Data collection is commonly conducted directly from a participant through the distribution of a questionnaire with a set of pre-determined questions.
	Cohort study	Longitudinal study where a group of people are observed over time to explore predictive risk factors and health outcomes. This can be prospective or retrospective.
	Case-control study	Studies where participants are selected because of what has happened, such as a diagnosis of a disease or condition of interest; whilst a control group of participants without the disease or condition are usually matched on demographic variables to compare and determine potential causative factors or previous exposures.
	Case report or case study	An in-depth study of a single individual or specific group of participants where there are unexplained or adverse outcomes to treatment, emerging conditions, atypical behaviour or new methods of treatment.

Experimental Studies: - *Studies where researchers introduce an intervention and study the effects*	**Randomised controlled trials**	Participants are randomly assigned to one or two more clinical interventions or a control group who received standard treatment to identify effectiveness, side-effects, cost, patient adherence, and duration of effect.
	Non-randomised controlled trials	Participants are allocated to different interventions using methods that are not random
	Pre-test-Post-test designs	Studies that look at the outcomes of interest before an intervention, then after an intervention where there is no randomisation and/or control group

2.5.3 Mixed-method research

There has been an upsurge of interest in mixed-methods research within health research, where both qualitative and quantitative methods are combined to allow a broader and deeper understanding of complex human phenomena(139, 150). Mixed-methods research aims to integrate both qualitative and quantitative approaches, rather than keeping them separate(138). Intentionally integrating both qualitative and quantitative data maximises the strengths whilst minimising the weakness of each type of data. Therefore, it can be used to gain a better understanding of connections or contradictions between qualitative and quantitative data. Creswell and Plano Clarke discussed the three approaches to integrating different forms of data (see Table 7)(139, 151).

Table 7: Approaches to integrating different forms of data

Approach	Description
Merging data	Combines qualitative data in the form of texts or images with quantitative data in the form of numeric information. This can be achieved by reporting results together through the use of tables or figures that display both qualitative and quantitative results or reporting quantitative statistical results followed by qualitative quotes or themes that support or refute quantitative data.
Connecting data	Involves analysing one dataset in the first phase of research, and then using the findings to inform subsequent data collection in the second phase of research
Embedding data	A dataset of secondary prior embedded within a larger, primary research study design typically used in interventional trials

The main benefits and rationale of conducting a mixed-methods study are that it allows for greater validity by seeking corroboration between qualitative and quantitative data and provides a more comprehensive understanding of the study phenomenon(150, 152). It also provides a greater repertoire of tools to meet the aims and objectives of a study that cannot be answered by using qualitative or quantitative methods alone(152). A mixed-methods study can use qualitative research methods to explain the data generated from a study using quantitative methods, and vice versa. This is particularly useful when unanticipated findings emerge from the data(152). Furthermore, an initial qualitative phase may be conducted to develop a hypothesis which can then be tested in a follow-up quantitative phase or be used to generate items for inclusion in a questionnaire used in a quantitative phase of the study(150, 152). However, it is rare for an individual researcher to be equally skilled in both qualitative and quantitative methods(137). Therefore, a challenge of mixed-methods research is that researchers may integrate methods that they poorly understand and consequently create results that are not methodologically sound. Another challenge of mixed-methods studies arises during the analysis and interpretation of data where findings of each study phase may conflict with each other and the strategy of resolving differences need to be carefully considered. Interpretation of integrated qualitative and quantitative data may be challenging due to the unequal emphasis placed on each dataset by the researcher and the accuracy or validity of each dataset.

A mixed-methods approach, connecting data by using findings from the initial Work Packages to inform subsequent Work Packages was chosen for the PD Life Study. This approach enabled a deeper understanding of the treatment burden and capacity amongst PwP and caregivers, which has not been specifically studied in PD. Firstly, the **systematic review and qualitative synthesis** (Work Package 1) explored the experiences of treatment burden among PwP and caregivers from published qualitative studies. These findings were explored further through a primary qualitative study conducted using **interviews** with PwP and caregivers (Work Package 2) in the local region. Integrating the findings from the systematic review and interviews generated a hypothesis of the potential issues and factors associated with treatment burden and capacity that were explored in a wider population through a **national survey** (Work Package 3). The **focus groups** (Work Package 4) conducted then enabled discussion of the overall findings to develop recommendations of ways to improve the treatment burden and capacity experiences in PD. The methodological considerations for each Work Package are described next.

2.6 Work Package 1 – Systematic Review and Synthesis of Qualitative Studies

A **qualitative systematic review** is a method of scientific enquiry through which the findings from individual primary qualitative studies that relate to a specific topic of interest or phenomenon are rigorously aggregated, integrated and/or interpreted(153, 154). It follows a transparent, systematic, and rigorous method to synthesise evidence from primary qualitative studies to reach a new or deeper understanding of a phenomenon(155). Qualitative systematic reviews are sometimes also referred to as qualitative evidence synthesis, qualitative research synthesis, or qualitative meta-synthesis(155).

I chose to conduct a qualitative systematic review in Work Package 1 to understand the experiences of treatment burden in PwP and their caregivers to achieve the following study objective:

- To explore the modifiable factors that influence the treatment burden of PwP and their caregivers, which will then inform Work Packages 2 (interviews) and 3 (national survey)

2.6.1 Why Conduct Qualitative Systematic Reviews

Qualitative systematic reviews can be invaluable in bringing together current health research evidence from primary qualitative studies to explore how and why patients make the decisions they do(156, 157). Indeed, the increase in published qualitative evidence syntheses over the last decade highlights the recognition for clinical policies that advocate shared decision-making to include not just views from healthcare professionals but also consider patient values, beliefs and preferences(156). For example, findings from a qualitative evidence synthesis involving patients and family members were incorporated together with quantitative evidence into NICE guidelines recommendations on the long-term management of stroke(156). Qualitative systematic reviews are also beneficial when seeking to understand the complexity, impacts and effects of healthcare system interventions, explain why an intervention works or does not work, and for whom and in what context(157). This may help with the development or scaling up of an intervention. Qualitative systematic reviews can be conducted as a research study in its own right to understand how a phenomenon of interest is experienced across multiple individuals described in multiple studies. This may potentially reveal new perceptions of the phenomenon and may subsequently help the development of a new theory. Qualitative systematic reviews have been used to explore the treatment burden and capacity of patients with LTCs other than PD including

heart failure, stroke, COPD, and lung cancer(81, 103, 105, 158, 159). Experiences of treatment burden can therefore be explored and interpreted from other primary qualitative studies involving PwP and caregivers. This was the rationale for conducting a qualitative systematic review in Work Package 1.

2.6.2 Methods for qualitative synthesis of data

There are approximately 30 different methodologies that can be used when conducting a qualitative systematic review, many based on analysis of primary qualitative research(155). Commonly used methods for qualitative synthesis of data will be described briefly in this section including: 1) framework synthesis, 2) thematic synthesis, and 3) meta-ethnography. Other methods used for qualitative synthesis are grounded theory, textual narrative synthesis, meta-study, meta-narrative, and critical interpretive synthesis although this list is by no means exhaustive(160). An extensive review of these methods is beyond the scope of this thesis but is briefly summarised in Table 8 (page 79) with the strengths and weaknesses of each method(155, 157, 160, 161).

Framework synthesis was developed from framework analysis which was created for primary qualitative studies(162). It has five stages: 1) Familiarisation: immersion in the included studies with the aims and objectives of the review, 2) Identifying or developing a thematic framework or existing theory, 3) Indexing: applying the framework to code individual studies, 4) Charting: charts contain distilled summaries of evidence, and 5) Mapping and interpretation: using the charts to define concepts, map the range and nature of the phenomena, create typologies and find associates between themes as a way of developing explanations of the findings. It is suitable as a method of analysis where there is a pre-existing theory or framework of the intended phenomenology(155). This approach to analysis is an iterative process and has been widely used to synthesise qualitative research(162, 163). However, one of the disadvantages of this approach is that the framework may be too constraining, and it is therefore important to keep an open mind throughout coding to avoid “fitting” the data into the chosen framework.

Thematic synthesis was developed by Thomas and Harden as they found the framework synthesis method of analysis was too constraining(164). It addresses questions around “what works” taking into account people’s views and experiences, predominantly concerning health promotion interventions. It is important with this approach to “go beyond” the primary studies with interpretive analysis and to avoid descriptions of included studies. It can be used with both ‘thick’ and ‘thin’ data to develop descriptive themes into more in-depth analysis themes(155). Thematic

synthesis has a clear approach and is likely to be the most approachable method for novice reviewers(157).

Meta-ethnography developed by Noblit and Hare is a complex approach to data analysis and is specifically used to develop a new theory or theoretical insights(165). This method relies on including studies that contain conceptually rich descriptions of both first- and second-order constructs from the extracted data(155). From my initial review of relevant articles, most articles do not describe a high level of detail regarding treatment burden in PD and contained 'thin' data for extraction. This made meta-ethnography less suitable for data analysis in Work Package 1 given the lack of 'thick' data. Furthermore, this method of analysis is complex and should be conducted by a researcher with qualitative experience rather than a novice researcher like myself.

Framework synthesis using **Eton's framework of treatment burden** was chosen over thematic synthesis as the method for data analysis in Work Package 1 as there was a suitable pre-existing framework of treatment burden. Qualitative synthesis of treatment burden experiences of other health conditions have used framework synthesis guided by Normalisation Process Theory and Cumulative Complexity Model(96, 159). As previously described in Chapter 1, there remains no consensus on the definition of treatment burden, with several conceptual frameworks of treatment burden developed since the introduction of the concept in 2009. Eton's framework of treatment burden was developed with patients with multimorbidity and therefore considered appropriate for use in the systematic review as PwP can be considered an exemplar for patients with multimorbidity(74). To my knowledge, Eton's framework has been used in primary qualitative studies of treatment burden in patients with COPD and patients with a kidney transplant, but not used in data analysis of qualitative systematic reviews(104, 166). Framework synthesis using Eton's framework of treatment burden is thus a novel approach for data analysis of the treatment burden experiences in PwP and caregivers.

Table 8: Overview of qualitative synthesis methods

Method (Year)	Main Use	Steps/Approach	Strengths	Weaknesses
Framework synthesis by Oliver et al (2008)(162)	If there is a pre-existing theory or framework	• Familiarisation • Identifying or developing a thematic framework or existing theory • Indexing • Charting • Mapping and interpretation	• Retains links to the original data • May help reporting of methods theory development more transparent	• Framework may be too constraining • May lead to overlooked themes that are grounded in the data that does not fit within the framework
Thematic synthesis by Thomas and Harden (2008)(164)	If there is no existing theory or framework	• Line-by-line inductive coding • Development of descriptive themes • Development of analytical themes	• Flexible and structured approach to identify key themes • Pragmatic approach that can be used with 'thin' and 'thick' data • Useful for integrating findings with intervention reviews	• May become a descriptive account of themes rather than higher level of interpretation • Diversity of approaches leads to uncertainty about how synthesis developed
Meta-ethnography by Noblit and Hare (1988)(165)	To develop new theory and theoretical insight	• Getting started • Deciding what is relevant to the initial interest • Reading the studies • Determining how the studies are related • Translating studies into one another: reciprocal translation, refutational translation, line of argument synthesis • Synthesising translations • Expressing the synthesis	• Provides a way to synthesise seemingly divergent findings and produce new high order constructs whilst preserving the interpretations of original studies • Requires primary studies that have "thick" or rich data for synthesis	• Complex methodology and requires a highly experienced research team • May be time-consuming and resource intensive • Lack of transparency regarding selection of primary studies

Grounded Theory by Strauss and Corbin (1998)(167)	To develop new theory	• Simultaneous phases of data collection and analysis • An inductive approach to analysis and allowing the theory to emerge from the data • The use of the constant comparison method • The use of theoretical sampling to reach theoretical saturation • Generation of new theory.	• Generates theory • Sampling to theoretical saturation can limit number of papers to review • Can potentially deal with diverse evidence types	• Lack of transparency • Variants are rife
Textual narrative synthesis by Popay (2006)(168)	A form of storytelling and to bring together evidence	• Developing a theory of how the intervention works, why and for whom • Developing a preliminary synthesis of findings of included studies • Exploring relationships in the data • Assessing the robustness of the synthesis	• Useful in synthesising different types of research evidence (qualitative, quantitative) • Useful in describing differences in the included studies	• Lack of transparency
Meta-study by Paterson et al (2001)(169, 170)	To develop new knowledge of a phenomenon	• Meta-data-analysis which involves the study of empirical findings • Meta-method which examines the epistemological soundness and rigour of methods • Meta-theory which examines the structures, assumptions and principles underpinning the primary research studies • Meta-synthesis which brings the three steps together and considers the plausibility of existing accounts, what has been neglected and what new avenues have been opened for advancing knowledge	• Useful in synthesising heterogenous studies • Supports the examination of methodological strengths and weaknesses • Explicitly orientated towards production of mid-range theory	• Advanced method for seasoned researchers • Can risk decontextualising data from the original studies

Meta-narrative by Greenhalgh (2005)(171)	To synthesise evidence to inform complex policymaking	• An exploration of ways of understanding a particular phenomenon across a wide range of disciplines and research traditions	• Involves looking across different paradigms and research traditions	• Synthesis is challenging • Subjectivity required when categorising research traditions
Critical interpretive synthesis by Dixon-Woods (2006)(172)	To synthesise a wide range of research evidence	• Identifying an area of clinical interest and formulating the review question • Searching for studies • Translating studies into one another by systematically comparing findings from each study • Synthesising translations by integrating evidence across studies into a theoretical framework • Synthesising arguments to consider and reflect on the credibility of evidence and to make critical judgements	• Useful method to synthesise a large and diverse body of literature of different study designs to develop a conceptual method or theory • Flexible approach	• Lack of transparency and reproducibility

2.6.3 Conducting qualitative systematic reviews

2.6.3.1 Search strategy

There remains a debate on whether qualitative systematic review requires the need for comprehensive, exhaustive searches such as those required in traditional quantitative systematic reviews. Some argue that the purposive sampling approach to reach data or theoretical saturation may be more appropriate when conducting a qualitative systematic review(173). However, others argue that rather than include a sample of the literature, all possible qualitative studies should be included to make an accurate and valid assessment of the phenomenon in question(174, 175). Searching for qualitative research continues to be an area with ongoing methodological development. One of the challenges of searching for qualitative studies is due to the inadequate refinement of the indexing of qualitative articles on electronic literature databases(173, 174, 176). For example, the MEDLINE database does not include the term “qualitative” as a Medical Subject Headings (MeSH) term, which can make retrieval of qualitative articles challenging(174). Furthermore, there are also differences between electronic literature databases in how qualitative articles are indexed(177). For instance, comparing the indexing of the same qualitative article on both MEDLINE and Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases, the indexing in CINAHL used terms that more accurately reflect the qualitative methodology of the article compared to MEDLINE. Therefore, including several different databases when searching the literature when conducting a qualitative systematic review can help mitigate this challenge(174, 177).

Gallacher et al discussed the methodological challenge of searching for qualitative articles and recommended potential solutions to create a sensitive and specific search strategy based on their experiences of conducting three qualitative systematic reviews relating to patient experiences of treatment burden in stroke, heart failure, and diabetes(176). The concept of treatment burden had not been previously defined or indexed in literature at that point. Consequently, they highlighted the importance of conducting scoping reviews before developing a search strategy. This helped establish the key papers and keywords that could be used to develop the search strategy. Furthermore, they found that the addition of “qualitative methods” as a concept in the search strategy helped increase specificity, whilst retaining sensitivity of the search results. Booth et al’s structured overview summarised other methodological search strategies when conducting qualitative systematic reviews(178). One method of developing the search strategy includes the use of qualitative research filters specific to each database. Another method that can be used is

searching with broad qualitative terms such as “qualitative research”, “qualitative studies” and “interview” which may be equally applicable to all databases.

Therefore, I conducted an initial scoping review to help identify key papers and keywords before finalising the search strategy across five databases in Work Package 1. The search strategy was also developed with support from my supervisors and the University of Southampton librarian, who has vast experience in conducting literature searches on various databases. This is described in Section 3.2.1 (page 108).

2.6.3.2 Quality appraisal

There remains no consensus on how best to critically appraise qualitative research studies. One review reported that there are nearly 100 quality appraisal tools to assess the quality of primary qualitative studies(179). Furthermore, there is ongoing debate regarding the inclusion or exclusion of studies based on quality appraisal. Studies rated as high quality may have sound methodology yet suffer from poor data interpretation with inadequate insight into the studied phenomenon(180). Likewise, excluding studies rated as low quality may risk the exclusion of valuable insights from data synthesis(161). Despite this, quality appraisal of studies is considered essential within systematic reviews, even when studies are not excluded based on their quality. As treatment burden had not been explored previously in PD, studies were not excluded based on quality in the systematic review to ensure all perceptions of this concept were included.

In the absence of a definitive risk to rigour tool, the Cochrane Handbook recommends that any tool used should focus on the assessment of the methodological strength and limitations of qualitative studies based on seven domains(157). The Critical Appraisal Skills Programme (CASP) tool for qualitative research is a checklist-style approach that consists of ten questions that map onto these recommended domains of study (see Table 9, page 84)(181). It has two screening questions based on the aims of the study and appropriateness of qualitative methodology, followed by eight appraisal questions on research design, recruitment strategy, data collection, reflexivity-related issues, ethical issues, rigour of data analysis, reporting of findings, and value of findings. Each question is answered with a ‘Yes’, ‘No’ or ‘Can’t Tell’. It enables the researcher to consider whether the appropriate research method was used and whether the findings are well-presented and meaningful. The CASP is easy to understand and administer and is easy to use(182). It is the most used quality appraisal tool in health-related qualitative evidence synthesis and is recommended for novice qualitative researchers(183). A limitation of the CASP is that it seems to be the least sensitive in appraising the validity of methodological quality compared to other appraisal tools(184).

Table 9: Domains to determine study rigour and Critical Appraisal Skills Programme tool

Seven domains to determine study rigour as recommended by the Cochrane Handbook(157)	**Critical Appraisal Skills Programme tool for Qualitative Studies (10 questions)**
Clear aims and research question	• Was there a clear statement of the aims of the research?
Congruence between the research aims/question and research design/method	• Is qualitative methodology appropriate? • Was the research design appropriate to address the aims of the research?
Rigour of case and/or participant identification, sampling and data collection to address the question	• Was the recruitment strategy appropriate to the aims of the research?
Appropriate application of the methods	• Were the data collected in a way that addressed the research issues? • Have ethical questions been taken into consideration?
Reflexivity of researchers	• Has the relationship between the researcher and participants been adequately considered?
Richness/conceptual depth of findings	• Was the data analysis sufficiently rigorous? • Is there a clear statement of findings?
Exploration of deviant cases and alternative explanations	• How valuable is the research?

Other quality appraisal tools such as the Joanna Briggs Institute (JBI) critical appraisal tool for qualitative research and Evaluation Tool for Qualitative Studies (ETQS) were also considered for use in Work Package 1(185, 186). The JBI tool consists of ten questions that assess congruity between philosophical perspective, methodology, research question and objectives, data collection methods, data analysis and interpretation of results, reflexivity, voice of participants, ethics and coherence between conclusions and interpretation of data(185). Each question is answered with a 'Yes', 'No', 'Unclear' or 'Not Applicable'. Similar to the CASP tool, it is short and easy to use. However, a criticism of the JBI tool is that the main emphasis is on congruity between philosophy, methodology and methods(182). The ETQS is a very comprehensive tool containing 38 unstructured questions under four themes: 1) Phenomenon studied and context, 2) Ethics, 3) Data collection, analysis and potential research bias and 4) policy and practice implications(186).

A limitation of the ETQS is that it requires qualitative expert use and its length means that it is more time-consuming compared to other appraisal tools(182).

I chose the CASP tool for qualitative studies as the method for quality appraisal in Work Package 1 as it was easy to understand, easy to score, and enabled structured comparison and discussion with the second reviewer to reach a quality agreement. It is recommended for use by novice researchers like myself who had no previous experience in conducting quality appraisals for qualitative research in systematic reviews.

2.7 Work Package 2 – Interviews

As described previously, qualitative research methods can explain or describe the reasons behind a phenomenon based on a person's experiences in a specific context and situation. Work Package 2 involved qualitative methodology using **semi-structured interviews** with PwP and caregivers, building on findings from the systematic review that explored experiences of treatment burden from published qualitative studies. Conducting one-to-one interviews with PwP and their caregivers enabled me to gain an in-depth understanding of the factors that impact their treatment burden and capacity by asking them directly about their experiences of looking after their health with PD. The interviews aimed to achieve the following study objective:

- To explore modifiable factors that impact treatment burden and capacity of PwP and their caregivers; building on findings from Work Package 1 (systematic review) to inform Work Package 3 (national survey)

2.7.1 Qualitative Interviews

An interview is a method of collecting data in which both quantitative and/or qualitative questions can be asked(187). Quantitative questions are closed questions, whilst qualitative questions are open-ended questions. Qualitative interviews enable the researcher to develop a rapport with participants, explain the purpose of the research study, answer any questions about the study, and allow the researcher to observe as well as listen(187). Conducting qualitative interviews has its advantages and disadvantages(187). Some of the advantages of conducting qualitative interviews are that they allow the telling of the participant's story in more detail which can gain insight and context, help participants describe what is important to them, and explore participants' reasons for acting in a certain way or their interpretations of events. However,

disadvantages of conducting qualitative interviews are that they may seem intrusive or invoke strong feelings for participants depending on the phenomenon of interest, as well as being more time-consuming and expensive compared to other research methods. Qualitative interviews may also be susceptible to biases which include the participant's desire to please the researcher or create a good impression. For example, participants may then respond to questions based on what they perceive the researcher wishes to hear, rather than their own personal views. Similarly, the researcher's views or expressions can influence participants' responses.

2.7.1.1 Individual semi-structured interviews

There are three main types of qualitative interview methods: structured, semi-structured and in-depth interviews which are summarised in Table 10(187). One of the advantages of semi-structured interviews compared to unstructured interviews is that it allows for flexibility during the interview whilst having a set guide of questions which enables the researcher to explore new areas and produce richer data(142). In contrast to structured interviews, semi-structured interviews have the benefit of eliciting issues that may not have been anticipated by the researcher(142). These new issues may then be subsequently explored further with other participants.

Table 10: Interview Methods

Interview Methods	Description
Structured	Each participant is asked a specific set of questions using the same wording in a predetermined order with no flexibility with the assistance of an interview schedule that is adhered to throughout the interview
Unstructured	Often starts with a broad, open question where one or two issues are explored in detail with flexible and unrestricted subsequent questions depending on the participant's responses
Semi-structured	Follows a set of pre-determined questions for the topics covered with the opportunity to be flexible in the wording and order of questions as well as allow for further open-ended questions where the researcher is free to seek clarification based on the participant's responses

Interviews can be conducted individually or as a dyad. Individual interviews allow participants to share information that they may have otherwise withheld in a more public context and enables each participant to share experiences from their perspective(188). Comparatively, dyadic interviews bring together two participants who share a pre-existing role relationship such as married couples or partners(189). A crucial difference with individual interviews is that dyadic interviews include the interaction between participants, drawing responses from each other. Conducting dyadic interviews may allow sharing of ideas and recollection of experiences between participants that may have not been either recognised or remembered if interviewed individually. Dyadic interviews create a joint picture and shared narrative of experiences which can be a drawback as it may reduce the differences between the version of experiences due to participants being present together during the interview(188).

In this study, I chose to conduct **individual semi-structured interviews** with each participant separately rather than as a dyad with the person with PD and their caregiver. This allowed me to gain information on their perspectives, understanding, and experiences of treatment burden and capacity with the opportunity to be flexible based on their responses. Furthermore, the experiences of the person with PD who manages their health on their own may be different than those who require help and support from a loved one. Therefore, individual interviews were chosen to capture a broad range of experiences and ensure that each person with PD and each caregiver of someone with PD was able to express their own views and experiences of treatment burden and capacity.

2.7.1.2 Mode of interviews

The initial study protocol planned to conduct face-to-face interviews with participants at their chosen location and convenience. Due to the COVID-19 pandemic, the study protocol was amended to include options for telephone or virtual interviews online to ensure that data collection could continue. Some of the advantages and disadvantages of each interview mode are summarised in Table 11 (page 88)(190, 191).

Table 11: Comparison of interview modes

Interview Modes	Advantages	Disadvantages
Face-to-face	• Able to build rapport and trust more easily • Able to read social cues and judge non-verbal behaviour such as voice, intonation, body language and facial expression • Allows for a spontaneous response without extended reflection	• Potential for bias • Less anonymity may prevent open conversations and data collection of sensitive issues • Need for travel can take more time and is associated with higher costs
Telephone	• Logistical and practical conveniences, allowing for wide geographical access and harder-to-reach populations • Perceived anonymity with increased privacy may help data collection of sensitive issues • Lower costs	• May have problems building rapport and trust • Issues with hearing or speech clarity may be a problem • Usually shorter, although this does not mean less in-depth • Reduction of ability to respond to social and non-verbal cues
Virtual or online	• Lower costs and no need for travel • May increase accessibility and flexibility for participants • May be less intrusive for participants • Transcripts may be available immediately with the use of specific software	• May have problems building rapport and trust • Requires ability to access technology as well as audio and/or video equipment which may contribute to digital exclusion • Technological or connectivity difficulties may occur and interrupt the interview

When arranging the interviews, most participants commented on their dislike for the telephone interviews due to their poor hearing and concerns about feeling fatigued whilst using the telephone. Only one participant in Work Package 2 chose to conduct a virtual interview. Despite the potential for poor rapport during the virtual interview, I felt that I was still able to have a good relationship with the participant. The participant opted not to turn their video on during the recording, which may have helped maintain a level of perceived anonymity and encouraged open discussion of their views and experiences. I made sure to turn my video on throughout the interview, which hopefully still enabled appropriate non-verbal responses to the answers such as active listening. No technological or connectivity issues occurred during the interview.

2.7.2 Sampling and Recruitment

Participant sampling for qualitative interviews can be categorised into random and convenience sampling, or purposive sampling(192). Random sampling uses a method of random selection from a list of all cases within the sample population such as a random selection of numbers from a phone book. Convenience sampling selects participants based on locating any convenient cases that meet the required inclusion criteria that are easily accessible to the researcher on a first-come-first-served basis until the sample size is achieved. It is affordable, easy to conduct, and participants are potentially more readily available. A disadvantage of both random and convenience sampling in qualitative research is that it may not be representative of the wider population sample(192). Purposive sampling is a non-random method where the selection of participants' characteristics within a population are defined for a purpose that is relevant to the study and outcomes(192, 193). Gaining a heterogeneous sample can provide evidence of findings that are not specific to a particular group, time, or place(192). With purposive sampling, the research assumes based on their inferred theoretical understanding of the phenomenon of interest that certain categories of individuals may have unique, contrasting perspectives(192, 194).

A purposive sampling method using heterogenous or maximum variation sampling was used for the recruitment of participants to the interviews in Work Package 2. This was chosen to get a wide range of experiences of treatment burden from participants and is described further in Section 4.2.1 (page 150)(193, 194). The interviews continued until each category of purposive sampling was achieved and data saturation was achieved. Guest et al describes data saturation as the ‘gold standard by which purposive sample size is determined in health science research(195). Data saturation is achieved at the point when no new information, codes or themes are observed in the data. This meant that no new data regarding aspects of treatment burden or capacity when living with PD were noted from the interviews with the selected heterogeneous sample of participants, allowing the study aim to be achieved.

2.7.3 Thematic analysis

Qualitative analysis involves the non-numerical organisation of data to discover patterns or themes that aim to capture the depth, breadth, and complexity of people’s experiences(196). There are multiple methods for qualitative data analysis. Some of the common methods for qualitative analysis include grounded theory, thematic analysis, narrative analysis, framework

analysis, and discourse analysis. This section will focus on **thematic analysis** as the chosen method for qualitative data analysis in Work Packages 2 (interviews) and 4 (focus groups).

Thematic analysis is a method for "identifying, analysing, and reporting patterns (themes) within data"(197, 198). It was initially developed by Braun and Clarke in 2006 who suggested that thematic analysis should be the first method of qualitative data analysis that researchers should learn as it forms an important foundation that also provides skills that will be beneficial for conducting other methods of qualitative analysis. Thematic analysis organises and describes data in rich detail and in addition to this allows interpretation beyond the descriptions when selecting codes and constructing themes. It is not defined by any pre-existing theory or framework and therefore is a method that works both to reflect reality and to untangle the surface of reality of the phenomenon of interest, i.e., the aspects of treatment burden and capacity in PD in this study. There are six main phases of thematic analysis with flexibility to move between phases during the analytic process (see Table 12)(197).

Table 12: Phases of thematic analysis adapted from Braun and Clarke 2006(197)

Six phases of thematic analysis	Description of each phase
1. Familiarising yourself with the data	• Transcribing data • Reading and rereading the data, noting down initial ideas
2. Generating initial codes	• Coding interesting features of the data in a systematic fashion across the entire data set • Collating data relevant to each code
3. Searching for themes	• Collating codes into potential themes • Gathering all data relevant to each potential theme
4. Reviewing themes	• Checking in the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2) • Generating a thematic 'map' of the analysis
5. Redefining, defining, and naming themes	• Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells • Generating clear definitions and names for each theme
6. Producing the report	• The final opportunity for analysis. • Selection of vivid, compelling extract examples, the final analysis of selected extracts, relating the analysis back to the research question and literature • Producing a scholarly report of the analysis.

Reflexive thematic analysis is an evolving approach to thematic analysis by Braun and Clark who published their practical guide book in late 2021 after I had started my research(198, 199). They emphasise how the researchers' knowledge, subjectivity and interpretation are integral throughout the process and should be seen as an analytic resource. Reflexive thematic analysis often has an inductive approach, with coding an organic and flexible process alongside detailed engagement with the data leading to the generation of themes. Themes are not summaries of the data topics or codes, but rather multifaceted and seek to capture shared meaning underpinned by a central concept to tell a story about the data. It is helpful to reflect on how my analytic approach overlaps with reflexive thematic analysis. Prior theoretical knowledge of treatment burden frameworks, findings from Work Package 1 as well as my clinical experiences as a specialist registrar in geriatric medicine conducting regular PD clinics would have had unavoidable influences in the interpretation and data analysis in Work Packages 2 and 4. This is discussed further in Section 2.10 (see page 103). Drawing on my position and consciously ensuring that I did not limit myself to what was already known positively aided the generation of themes that reflected the data. Multiple reflexive discussions with my supervisor (KI) to discuss the themes generated and challenge my interpretation during data analysis should hopefully minimise any biases or assumptions I may have had about the data. Reflexive thematic analysis embraces this subjectivity and creativity of the researcher, rather than being construed as a limitation.

Thematic analysis has its strength and weaknesses(197, 200). A major benefit of thematic analysis is that it is relatively easy to do and allows for a highly flexible approach to the interpretation of the data that can be modified for the needs of many studies. However, the flexibility in thematic analysis can lead to inconsistency and a lack of coherence during the development of themes derived from the data(200). This can be a disadvantage, particularly when used by a novice researcher who may not be sure of how to conduct rigorous thematic analysis. Nowell et al described their step-by-step approach within each phase of thematic analysis to help establish trustworthiness in qualitative research(200). For example, during phase four of thematic analysis (reviewing themes), means of establishing trustworthiness include research triangulation, vetting of themes and subthemes by team members and testing for referential adequacy by returning to the raw data. I conducted this with close support from my supervisors by having multiple discussions to review the data and ensure data interpretation reflected the experiences of PwP and caregivers. Another advantage of thematic analysis is that it enables a rich, detailed, and yet complex account of data to be summarised. Thematic analysis is a useful method to examine the perspectives of different research participants as well as highlight any similarities and differences across the data set. This method is easily grasped and can be relatively quick to learn which made it useful for me as I was relatively new to qualitative data analysis.

2.8 Work Package 3 – National Survey

Building on findings from the systematic review and interviews, Work Package 3 of the study consisted of a **national survey** for PwP and their caregivers. A cross-sectional survey was chosen as it would enable exploration of the extent and levels of treatment burden in a wider national population level using the Multimorbidity Treatment Burden Questionnaire (MTBQ), a validated measure of treatment burden.

The national survey aimed to achieve the following study objectives:

- To explore modifiable factors that impact the treatment burden and capacity of PwP and their caregivers
- Identify the association of multimorbidity and frailty on treatment burden in PwP and their caregivers

2.8.1 Development of National Survey

The national survey was built on findings from Work Packages 1 and 2 as well the Dorset Treatment Burden Survey study. The Dorset Treatment Burden Survey study was a cross-sectional postal study led by one of my supervisors (SF) that explored the treatment burden among older adults with multimorbidity living in Dorset(113). This study published by Morris et al recruited 835 people with more than three LTCs (mean age=75 years) from primary care to determine the extent of treatment burden using the MTBQ and to explore characteristics associated with high treatment burden(113). Results from Work Package 3 will therefore also contribute to a common dataset of treatment burden and user experiences of patients with LTCs living in Wessex through the NIHR ARC Wessex research programme.

Two separate anonymised surveys were created for the PD Life study: one for the person with PD and one for the caregiver of someone with PD, with closely matched questions as far as possible in both surveys. The person with PD could participate in the survey even if they did not have a caregiver or if their caregiver did not want to. Similarly, the caregiver of someone with PD could participate in the survey even if the person with PD they care for was unable to or did not want to. The national survey was distributed in both paper and online format. The paper format of the survey included information on how to complete the survey online if participants preferred. The online survey was developed on the SmartSurvey platform which is used and recommended by Parkinson's UK who supported participant recruitment to the study. Therefore, it would be a familiar platform to navigate for participants when completing the online survey. The

SmartSurvey platform is compliant with General Data Protection Regulation and has ISO27001 certification. All data collected through the SmartSurvey platform is kept in the UK in a secure data centre.

Both surveys for PwP and caregivers consisted of eight sections, with all data self-reported. Basic sociodemographic data, PD and health characteristics were collected. Data related to aspects of treatment burden including medication use, information provision and use of healthcare services were collected. Data related to healthcare service use for issues related to PD in the last 12 months included contact with a PD specialist, PD nurse specialist, physiotherapist, occupational therapist, speech and language therapist, dietician, and older people mental health team. The number of times participants contacted their GP both related or not related to PD were obtained, as well as the number of hospital attendances in an emergency, and attendance of paramedics at their home. Additional questions related to treatment burden and capacity that were included following the interviews were prescription management, preference for information levels provided, access to PD nurse specialists, access and ability to use technology, access to a car, and ability to drive.

The MTBQ was used to measure treatment burden levels(80). Other data collected were the single-item treatment burden question, Hoehn and Yahr (H&Y) stage as a measure of PD severity, Non-Motor Symptoms Questionnaire (NMSQuest), disease count as a measure of multimorbidity, a frailty measure using the Program of Research to Integrate Services for the Maintenance of Autonomy (PRISMA-7), Medical Outcomes Study Short Form version 2 (SF12v2) as health-related QoL measure, and the single-item literacy score (SILS) as a measure of health literacy. The caregiver survey also included a measure of caregiver burden using the Zarit Burden Interview (ZBI). These measures are described in the next subsections.

2.8.1.1 Multimorbidity Treatment Burden Questionnaire

Treatment burden levels for PwP and caregivers were measured using the MTBQ which was previously described in Section 1.8.3 (page 57)(80). Permission for use was obtained for use in this study. The MTBQ was developed and validated in older people (mean age=71 years) with multimorbidity in the UK and therefore considered suitable for use in PwP. The MTBQ research team developed two versions of the questionnaire: a 10-item MTBQ and a 13-item MTBQ. Three optional questions: 1) paying for prescriptions, over-the-counter medication or equipment, 2) getting healthcare in the evenings and at weekend and 3) getting help from community services (e.g. physiotherapy, district nurses etc) may be included if felt to be useful to other patient groups. Given the inevitable progression of PD and the potential need for equipment to help with

mobility and activities of daily living, increasing health complexity and risk of falls which may require help out-of-hours as well as the importance of a multidisciplinary approach when managing PD, these additional questions were considered highly relevant to the treatment burden experienced in PwP and caregivers in this study. Therefore, the 13-item MTBQ was included in the survey for PwP (see Appendix A, page 305). The MTBQ research team also created a caregiver version of the MTBQ and consented to its use in this study, although this has not been fully validated. Following interviews with a small number of caregivers, the caregiver MTBQ consists of 16 items which include three further questions: 1) arranging respite care for the person you care for, 2) the financial impact of being a carer (e.g. having to give up work, relying on benefits etc), and 3) adjusting your own lifestyle so that you can look after the person you care for. The 16-item caregiver MTBQ was included in the survey for caregivers (see Appendix C, page 311).

Other measures of treatment burden described in Section 1.8 (page 55) were also considered. The Treatment Burden Questionnaire (TBQ) was developed in France and validated in a younger population compared to the MTBQ, whereas the three versions of the Patient Experiences of Treatment Burden and Self-Management (PETS) measure (PETS v1.0, PETS v2.0, Brief PETS) were developed and validated in the USA, and are considerably longer (32, 48 or 60 items) than the MTBQ(87, 114, 119, 201). The MTBQ was chosen given the shorter length and simple wording of the questionnaire as well as having been validated in the older population in the UK(80).

2.8.1.2 Single-item treatment burden measure

The Dorset Treatment Burden Survey study explored a single-item treatment burden measure which was previously described in Section 1.8.4 (page 58)(113, 120). A measure of treatment burden that is quick to complete as well as accurate may be potentially useful in busy clinical settings to help clinicians identify patients who may have high treatment burden. Therefore, the refined single-item treatment burden measure "*Have you felt overstretched by everything you've had to do to manage your health in the last month (e.g. taking medications, getting prescriptions, attending appointments)?"* was included in the national surveys as an exploratory measure for both PwP and caregivers(120).

2.8.1.3 Assessment of PD Severity

Findings from Work Packages 1 and 2 highlighted the potential impact of PD severity on the treatment burden and capacity of PwP and caregivers. Consequently, the length of PD diagnosis (years) and Hoehn & Yahr (H&Y) scale were included to assess PD severity(33). As discussed in

Chapter 1 (see Table 2; page 33), the H&Y scale is a well-recognised and widely-used measure of PD severity describing the progression and level of disability from stages 1-5(33, 202). It correlates with motor decline and deterioration in the QoL in people with PD(202). The Movement Disorder Society (MDS) Task Force for Rating Scales in PD support the use of the H&Y scale to measure PD progression and severity and concluded that it is easy to apply, quick to complete, and practical for use in research and patient care settings(202). However, the MDS report also recognised several limitations of the H&Y scale such as the possibility of ambiguity due to the combination of both motor impairment and disability in the scale, the lack of standard procedural assessment, and the lack of other motor and non-motor features of PD such as autonomic nervous system dysfunction and cognitive impairment.

The Unified Parkinson's Disease Rating Scale (UPDRS) is another widely used measure of PD severity and progression that was initially developed in the 1980s when PD was considered to be predominantly a motor disease(203). It did not capture important NMS such as constipation, fatigue, and sleep disturbance. In 2008, it was updated by the MDS and is now referred to as the MDS-UPDRS which consists of four parts: 1) non-motor experiences of daily living, 2) motor experiences of daily living, 3) motor examination and 4) motor complications(203). Parts of the UPDRS are completed by the patient with or without help from their caregiver, whilst the other parts are completed by an independent assessor, usually a healthcare professional with clear instructions for the scoring system provided on the questionnaire. The estimated time taken to complete the MDS-UPDRS for a full assessment of severity is under 30 minutes. The length and complexity of the UPDRS as well as the need for an independent assessor meant that it was considered not appropriate for this survey.

Therefore, the H&Y was chosen alongside the length of PD diagnosis as a measure of PD severity in the surveys. Yet, it is important to recognise the limitations of self-reported H&Y scoring by patients or their caregivers(204). A small study investigated the inter-rater reliability among neurologists, patients and caregivers on the H&Y scale(204). They found significant agreement on the H&Y scale among patients who attended with their caregivers (N=37) compared to physician rating on the H&Y. However, for patients who attended without caregivers (N=24) there was no significant agreement on H&Y ratings, and those patients were more likely to rate themselves as more functional and less debilitated. H&Y is a well-validated measure that is simple for participants to complete on their own despite its limitations with self-reported scoring.

2.8.1.4 Assessment of PD Non-Motor Symptoms

Findings from Work Packages 1 and 2 also suggested that PD symptoms may impact treatment burden and capacity. Therefore, the Non-Motor Symptoms Questionnaire (NMSQuest) was included in the survey for PwP. The NMSQuest is a well-validated measure used internationally across all stages of PD patients designed to highlight the presence of NMS experienced by PwP in the last four weeks(205-207). It was devised as a self-reported screening tool for healthcare professionals and has been used in multiple research studies to quantify the presence of NMS in PD(207, 208). Consisting of 30 questions on a single page with 'Yes' or 'No' options, it includes a comprehensive assessment of the myriad of NMS that may be present. A total score is calculated by adding all 'Yes' responses, representing the number of NMS of each respondent. It has good patient acceptability (90% of patients reported the questionnaire was easy to understand and relevant) and is commonly used before clinical appointments, taking an average of 5-7 minutes to complete(205). Other measures of NMS in PD are the Non-Motor Symptom Scale (NMSS) or MDS Non-Motor Rating Scale (MDS-NMS)(209, 210). The NMSS is a 30-item rater-completed scale administered by healthcare professionals that can accurately measure the severity and frequency of NMS and takes approximately 10-15 minutes to complete(209, 211). The MDS-NMS has 52 items and is a revision of the NMSS to help measure the burden of NMS including non-motor fluctuations in PD patients(210). The NMSQuest was included in the survey for PwP as it was designed to be completed by participants in their own time and has the shortest length of time taken to complete. This will help reduce the survey burden on participants. A license of use from the MDS was obtained for use in this study.

Based on caregiver experiences reported in the interviews, it was hypothesised that the presence of NMS may also impact caregiver treatment burden levels. Therefore, it was important to capture NMS of the person with PD in the caregiver survey. However, there are no validated measures of NMS in PD from the caregiver's perspective. I devised three relevant questions in the caregiver survey on whether the person with PD they care for has experienced any problems with 1) mood, 2) memory, and 3) hallucinations in the last 12 months. These NMS have been reported to contribute to caregiver burden(66). This was a pragmatic decision to capture potential associations of the PD symptoms that may impact caregiver treatment burden.

2.8.1.5 Measure of multimorbidity – Disease count

There are several ways of defining and scoring multimorbidity (presence of two or more LTCs) such as disease count, weighted Charlson Comorbidity Index (CCI), Cumulative Illness Rating Scale (CIRS), Chronic Disease Score, and Adjusted Clinical Groups Systems(212). Charlson et al

developed the CCI in 1984 as a method of predicting mortality by classifying or weighting patient comorbidities for use in longitudinal studies. A weighted score between one to six was then assigned to a list of 17 specific health conditions based on the relative risk of one-year mortality. The CIRS is another measure of multimorbidity that takes into account health conditions based on body systems whilst also including the severity of disease graded from zero to four (no disease to extremely severe problems)(213). The CCI was initially chosen as the measure of multimorbidity for inclusion in the survey(214). However, following a review of the survey by our PPI group, they expressed that the health conditions listed on CCI were too specific, may be difficult for participants to understand, and may increase the survey burden as participants had to read through all the listed health conditions to consider which applied to them. Instead, they recommended a free-text answer box for participants to self-report their health conditions. This generated a disease count as a measure of multimorbidity for use in this survey.

A systematic review of 194 articles found that disease count was the most commonly used measure of multimorbidity in primary care and community populations research studies(212). Disease count was also shown to perform similarly to complex measures of multimorbidity when predicting outcomes, including mortality(212). However, self-reported health conditions may have significant variation compared to primary care health records amongst older people living in the community(215). Furthermore, concordant comorbidities in PD that are coded in primary care records such as constipation or pain may not be recognised as separate health conditions by individuals with PD, but rather a symptom of PD(41). Therefore, whilst disease count of self-reported health conditions other than PD is a widely used measure, this may not be a true reflection of multimorbidity as participants may underreport their health conditions in the survey. A review of primary care records for survey participants may reduce this limitation and should be considered for future studies.

2.8.1.6 Frailty measure – PRISMA-7

Several tools have been developed to identify frailty in the older adult population although none have been recommended or validated in PD(46, 48). A recent systematic review and meta-analysis (N=30) by McMillan et al found that the frailty phenotype method (N=15) and the Canadian Study of Health Clinical Frailty Scale (CFS) (N=9) were the most used tools to screen for frailty in PD(48). Fried et al defined the frailty phenotype as a clinical syndrome if three or more of the following criteria were present: unintentional weight loss (10 lbs in the past year), self-reported exhaustion, low physical activity, slowness, and weakness (using grip strength)(216). However, the potential overlapping manifestations of frailty and PD may lead to misclassifications and overdiagnosis of frailty in PwP using the frailty phenotype(46, 48). The CFS is another

measure of frailty based on clinical judgement(217). Using the CFS, the assessor is required to make a judgement about the degree of frailty guided by images and descriptions following a formal clinical assessment that considers cognition, mobility, function, and co-morbidities. A frailty score is then generated ranging from one (very fit) to nine (terminally ill), with frailty defined as a score of four or greater. Although both these measures are commonly used, the frailty phenotype requires measurement of grip strength, whilst the CFS is measured based on clinical judgement. Therefore, these frailty measures were not chosen for inclusion in this national survey.

The Program of Research to Integrate Services for the Maintenance of Autonomy (PRISMA-7) was developed as part of a large Canadian study and used as a case-finding tool to identify frailty amongst older people living in the community (N=736, age >75 years)(218). It consists of seven dichotomous questions, each scoring zero or one point. The questions include age, sex, general health, limitations on activities, use of equipment to help with mobility, and social support. A score of ≥3 is indicative of frailty. A systematic review that compared nine frailty tools in community-dwelling adults identified the PRISMA-7 as the most promising self-reported frailty screening tool with high sensitivity and moderate specificity for identifying frailty(219). It is also recommended by the British Geriatrics Society (BGS) as a quick and simple tool that can be used to assess frailty in community and outpatient settings(220). Therefore, the PRISMA-7 was chosen as the measure for frailty in both PwP and caregiver surveys as it is quick, simple, and easy to use(219).

2.8.1.7 Health-related quality of life – SF12v2

Although there are PD-specific health-related QoL measures available such as the Parkinson's Disease Questionnaire (PDQ-39) or its' shorter version (PDQ-8), a generic measure was considered more appropriate for this study(221-223). The use of a generic measure would allow for comparison between PwP and caregivers in the surveys. The 36-item Short Form Survey (SF-36) is a generic assessment of QoL developed in the USA that applies to multiple different diseases(224). It can be self-reported and completed from the perspective of the patient or completed through an interview. The SF-36 addressed eight domains: 1) physical functioning, 2) role limitations due to physical restrictions, 3) bodily pain, 4) general health perceptions, 5) vitality, 6) social functioning, 7) role limitations due to emotional issues, and 8) mental health. It is also recommended for use in PD by the MDS Task Force(223). The SF12v2 is a shortened form of the SF-36 consisting of 12 items that highly correlates with the SF-36(225). It produces two summary scores: 1) Physical Component Summary (PCS) and 2) Mental Component Summary (MCS). These scores are generated using norm-based methods and are standardised to the

general working-age population in the USA to have a mean of 50 and a standard deviation of 10, with higher scores indicating better QoL. It has been used in a large community-based postal survey conducted in the UK to explore the impact of PD on the QoL of both patients with PD (N=901, mean age=74 years) and caregivers (N=704, mean age=67 years)(226). Compared to the general population, they found that both PwP and caregivers had lower mean PCS (PwP=31.7, caregiver=46.23) and lower mean MCS scores (PwP=41.31, caregiver=44.02) indicating the substantial impact of PD.

The SF12v2 was chosen as the measure for QoL in both PwP and caregiver surveys as it has fewer items compared to the SF36 and will reduce the survey burden for participants. The SF12v2 was also used in the Dorset Treatment Burden Survey study. This will allow for a comparison of QoL between PwP and older adults with multiple LTCs within Wessex. A license for use and scoring software was obtained from Qualitymetric® for use in this survey.

2.8.1.8 Single-item Literacy Screener

Health literacy may be an important aspect of capacity in PD, particularly when managing information related to PD. There are many tools available to measure health literacy, some of which measure general health literacy, some that are disease- or condition-specific, and some that are population- or language-specific(227). None have been specifically developed or validated in PD. Examples of general health literacy measures include the Test of Functional Health Literacy for Adult, Rapid Estimate of Adult Literacy in Medicine, Newest Vital Sign and Single-Item Literacy Screener (SILS)(228-231). The SILS is a simple instrument designed to quickly identify patients in need of help with health materials by asking about the perceived frequency of needing help to read health-related written material(231). It is scored on a 5-point Likert scale, with ‘sometimes’, ‘often’ and ‘always’ responses depicting those who are at risk of low or limited health literacy. Responses of ‘never’ and ‘rarely’ depicted those without limited health literacy levels. It was validated in a large adult population (N=999, mean age=65 years) with diabetes recruited from primary care settings in the USA and performed moderately well in ruling out adult patients with limited reading ability. The SILS was chosen for inclusion in the survey to capture an aspect of patient capacity as it is brief and simple for participants to complete compared to other health literacy measures mentioned above. It was also included in the Dorset Treatment Burden Survey and found to be strongly associated with high treatment burden levels ($p<0.001$)(113).

2.8.1.9 Caregiver Burden - Zarit Burden Interview

A critical review of caregiver burden in PD published in 2017 by Mosley et al found that multiple measures of caregiver burden have been adapted for use in PD such as the Zarit Burden Interview (ZBI), caregiver burden inventory, and caregiver strain index(66). The ZBI is a well-validated global measure of the physical, emotional, and socioeconomic impact of caring for elderly individuals with neurological impairment(232). Although the 22-item ZBI was initially developed in 1985 among caregivers of people with dementia, it has been validated in caregivers of patients with PD and is the most commonly used caregiver burden measure in PD(66, 233). Subsequently, a shorter version consisting of 12 items (ZBI-12) was created(234). Each item has five ordered responses, scored from 0 = 'not at all' to 4 = 'extremely', with an overall score calculated (range 0-48). Higher scores represented higher caregiver burden levels. There is no universal cut-off score to indicate those with high caregiver burden. Instead, Zarit et al recommend the interpretation of scores based on the variability within a sample and within-person changes over time. However, Bedard et al suggest that a score of ≥17 on the ZBI-12 may be used to identify high burden based on the top quartiles scores of their study sample involving caregivers of community-dwelling older adults with cognitive impairment (N=413, mean age=61 years)(234). A study conducted in Sweden compared the use of the ZBI-22 and ZBI-12 amongst family caregivers of PwP (N=66, mean age=70 years) and supported the use of the ZBI-12 as a measure of caregiver burden in PD without adding to the survey burden(233). The ZBI-12 was therefore chosen for inclusion in the caregiver survey in this work package. A license for the use of the ZBI-12 was obtained for this study.

2.8.2 Considerations for Quantitative Data Analysis

Detailed data analysis for the surveys is described further in Section 5.2.3 (page 202). Important considerations for quantitative data analysis for the national surveys are described in this section. Firstly, univariable and multivariable binary logistic regression were used to identify the relationship between the variables and medium/high treatment burden levels. Linear regression is used when the outcome is continuous, and therefore not suitable for this study. Statistical analysis using ordinal or multinomial logistic regression of all four treatment burden categories was also considered. Ordinal logistic regression is an extension of logistic regression and can be used where there is an outcome with clear ordering of category levels, such as the MTBQ(80, 235). However, on further discussion with an experienced statistician and review of the literature, it was felt that interpretation of the results can be challenging for an initial exploratory study. Furthermore, identifying associations between those with no or low treatment burden levels may not be clinically relevant as they may not require intervention.

Secondly, the selection of variables for inclusion in multivariable logistic regression models can be challenging and should be determined a priori based on the study design and sample size(236, 237). Pre-screening variables using univariable analysis is an approach that can be used to determine the inclusion of variables using a less stringent p-value <0.25(236, 238). However, others argue that if a variable is of interest based on the research question, this can be included in the multivariable model(237). Exclusion of non-significant variables should not be done as it may lead to the exclusion of a variable that may be an important confounder or the exclusion of a variable with clinical validity which can undermine the validity of the overall model(236). A combination of existing theory, literature, experience and clinical knowledge are all important when considering variables for inclusion in the models(239). In this study, variables were considered for inclusion in a final multivariable model based on previous studies of treatment burden in other conditions (age, number of medications, number of LTCs), those hypothesised to be clinically important (PD severity), and those shown to have p<0.25 at the univariable stage.

2.9 Work Package 4 - Focus Groups

The final Work Package of The PD Life Study consisted of **focus groups** with multiple key stakeholders including PwP, caregivers and healthcare professionals involved in the care of PD to achieve the following study aim:

- Develop recommendations of ways to improve the treatment burden and capacity among PwP and their caregivers

Focus groups are group interviews guided via a facilitated discussion to explore participants' experiences and draw on their collective expertise or knowledge(240). Focus groups are effective in generating broad overviews of issues of concern to the subgroups represented(241). They are also particularly helpful in evaluating user experiences and views of healthcare service and provision and in exploring why some healthcare is perceived as poor quality(143). The group setting and interaction between participants allow exploration of potentially contradicting opinions, with interactions between participants that allow them to question or challenge one another to explain or elaborate on their views(143). Compared to interviews that tend to probe participants' experiences, focus groups can generate broader data and deeper insights into phenomena due to the range of attitudes and experiences of participants(241, 242). Furthermore, participants may have more time to think before expressing their opinions or can opt to remain silent.

Nevertheless, there are some challenges with conducting focus groups. Firstly, some participants may feel unable to express their feelings or opinions as they may feel uneasy with each other or have fear of repercussions, especially when discussing sensitive topics(240, 243). Group settings may also be intimidating for some participants and lead to their reluctance to participate. Secondly, an outspoken individual may dominate the group discussion rather than allow interactions between all participants(240). To help reduce some of these challenges, consideration of the composition of focus groups and group size are important steps to take when planning a focus group(243). The composition of a group is important to enable the best quality of discussion. Participants may be selected based on characteristics such as age, gender as well as both personal and professional role concerning the research question being explored(244). Group size is another factor to consider when conducting focus groups, with the optimum size between six to eight participants, although as few as three participants can be successful(243). Small groups may limit discussions whilst larger groups can be difficult for the moderator to manage and limit opportunities for participants to voice their opinions(243).

In Work Package 4, **online focus groups** were chosen over interviews to allow discussion and generation of ideas for improvement between different key stakeholders with potentially contrasting experiences of treatment burden and capacity. A comparison between face-to-face and online modes of interviews was summarised in Table 11 (page 88) and is also applicable to focus groups(245, 246). Face-to-face focus groups tend to have higher rates of dropouts or non-attendance as it can be more time-consuming with the additional need for travel compared to the convenience of online focus groups(247). Although online focus groups may cause some participants to feel less included compared to being together in a room, awareness from the moderator of the group dynamics and fewer numbers of participants per group may overcome this limitation(247). Furthermore, due to the COVID-19 pandemic, online focus groups could encourage participation from those who may be more comfortable attending virtually than in person and enable data collection to continue.

2.9.1 Composition of Focus Groups

Participants in a focus group could be homogenous, grouping those with similar demographics or backgrounds together, or heterogenous, where there are differences in skills or knowledge(248). Both options have advantages and disadvantages and should be chosen based on the nature of the topic discussed(248). I opted to include PwP, caregivers and healthcare professionals in the same focus group as they all had experiences in healthcare delivery for PD, whether as service users or healthcare providers. The rationale for this was to allow discussion of their diverse

experiences and development of recommendations for ways to improve treatment burden that would work for both service users and providers. Whilst this could potentially influence interactions between participants due to the hierarchical societal role that healthcare professionals may have from a patient or caregiver point of view and fear of consequences to their healthcare provision, the clear establishment of their contribution towards a common ground by the moderator may mitigate this(249). Therefore, the moderator has a key role to play in establishing introductions and facilitating open exchanges when conducting focus groups(243, 249). Furthermore, part of this role includes guiding participants back to the focus group questions or encouraging the direction of participant responses based on the intended research question(250). Being a moderator of a focus group requires important skills such as the ability to think on your feet, respond to unpredictability, and contribute appropriate probing statements or questions(250). Each member should be allowed to express their views openly, and the moderator's role is to ensure that no single person dominates the discussion(251). It is also important that the facilitator limits their potential to lead participants based on their own views or experiences. My experiences in moderating the focus groups is discussed in Section 6.2.2 (page 250).

2.10 Reflexivity as a clinician conducting qualitative research

Clinical consultations and qualitative research interviews have very different aims(252, 253). The clinical task during consultations is to identify the medical issues to discuss the most appropriate medical management(253). Although the clinician may be willing to see the problem from the patient’s perspective, open-ended questions may be used less frequently than closed-ended questions due to time constraints with clinical consultations(253, 254). These time constraints may lead to excessive control of the interview by the clinician and inadequate probing of the participant’s feelings and meanings(254). Conversely, the aim of qualitative interviews as part of a research study is to explore the views and experiences of participants. It is important to be inquisitive to try and get an in-depth understanding of their views and experiences. Therefore, clinicians conducting qualitative research need to avoid imposing their own structure and assumptions based on their clinical knowledge where possible(253). As a clinician, although I am used to speaking to patients and caregivers as part of my clinical work, I had not conducted qualitative research previously. My own experiences of the healthcare system may have influenced the interviews with PwP and caregivers as I may have assumed an understanding of their experiences with the healthcare system and therefore did not include further probing questions. To minimise this bias, I attended two qualitative teaching sessions conducted by my

one of my supervisors (KI) as part of the MSc Allergy course at the University of Southampton and a course on conducting qualitative research prior to starting data collection.

Being a clinician conducting qualitative research has its advantages(252, 254). Firstly, there are interchangeable skills a clinician can apply during qualitative interviews such as responding techniques, observation skills and non-verbal communication(254). Furthermore, in the focus groups, I could draw on my experiences as a geriatric registrar working within multidisciplinary teams where it is important to listen to views from different perspectives and guide discussions back to a common goal. Secondly, clinicians may be placed in a position of greater trust due to their status and experience which can encourage research participation and exploration of potentially sensitive issues(255). In my experiences during the interviews, I found that all participants were comfortable answering questions related to their health and experiences with PD. I felt that all participants were aware that I was not there as their doctor to assess their symptoms or to give them any advice on their PD treatments. Although there were a few times during the interviews when participants asked me questions related to their PD, I was careful not to give specific treatment advice as I was not aware of their full medical history. However, given my knowledge and clinical experience managing PwP, I felt that I was able to address some of the generic questions related to PD such as the importance of exercise and heterogeneity amongst PwP. Furthermore, being a doctor specialising in geriatric medicine and conducting PD clinics meant that I felt that I was able to empathise with the experiences of both PwP and caregivers as I had met others with similar experiences previously. I was also able to support participants who may have felt distressed whilst talking about their difficult experiences with PD as I was used to having difficult conversations with patients and caregivers.

My clinical experiences and training were also likely to have influenced the qualitative data analysis process. As a specialist registrar in geriatric medicine, I conduct monthly PD clinics which enables me to gain first-hand experience in looking after the health of PwP and their caregivers. I also regularly manage the health of older patients with frailty and multiple LTCs. Therefore, I may have a bias towards the medical issues that I address in a clinical consultation with patients such as symptom management, medication review, and providing them with appropriate information about their health. However, my clinical training in geriatric medicine also means that I am also more aware of the importance of a multidimensional holistic assessment of an older person, and how psychosocial aspects of their lives can impact health. Multiple discussions and exchanging thoughts with my supervisors during the data collection and analysis process helped mitigate some of these biases.

2.11 Summary of Chapter

This chapter has discussed the methodology of the PD Life Study, justifying the mixed-methods approach of this exploratory study involving a qualitative systematic review, semi-structured interviews, a national survey, and focus groups. The methods and findings for each Work Package will be described in the subsequent chapters.

Chapter 3 Work Package 1 - Systematic Review and Synthesis of Qualitative Studies

3.1 Introduction to Chapter

This chapter describes Work Package 1 of the study, a qualitative systematic review and synthesis of the literature that was conducted to explore the treatment burden experiences of PwP and their caregivers. The methodological considerations of conducting a qualitative systematic review were previously discussed in Section 2.6 (page 76).

3.1.1 Rationale

As described in chapter 1, PD is a common, progressive neurodegenerative disorder. PwP are often older and may also have multimorbidity and frailty. They experience a variety of motor and non-motor symptoms (NMS) which may be more difficult to manage as PD progresses. There is currently no cure for PD and management of PD involves pharmacological and non-pharmacological treatments as well as input from a multidisciplinary team to achieve symptom control. Treatment with deep brain stimulation (DBS) may also be suitable for a few PwP if medications fail to achieve adequate symptom control. PwP may experience high treatment burden when looking after their health due to the imbalance between the workload of health and their ability to complete the workload with the available resources (patient capacity)(74, 76). The majority of PwP are supported by a caregiver who may also experience treatment burden when supporting someone with PD. Whilst no previous studies have explicitly studied the treatment burden experienced by PwP and their caregivers using either qualitative methods or treatment burden measures, aspects of treatment burden in PD can be interpreted from previous qualitative studies that have explored the experiences and views of PwP and their caregivers towards management of PD and their abilities to cope. Therefore, a systematic review of qualitative studies is an important first step that will allow us to gain rich and in-depth understanding from the perspectives of PwP and their caregivers specifically in the context of treatment burden and the effort of looking after their health.

3.1.2 Research Question

This systematic review aimed to address the research question: "*What are the experiences of treatment burden among PwP and their caregivers?".*

3.2 Methods

A systematic review and synthesis of qualitative studies using framework synthesis and adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) approach was conducted. The protocol was registered on the PROSPERO database: CRD42020172023.

3.2.1 Search Strategy

The search strategy was developed using the PICOS (Patient Intervention Comparison Outcomes Study) elements for qualitative studies as shown in Table 13 (page 109). This was created in consultation with my supervisors and with the help of a senior librarian at the University of Southampton. The keywords and phrases used were determined following an initial scoping review of the literature around treatment burden and the experiences of PwP and caregivers living with PD. The systematic review search strategy centred around the following key concepts: 1) experiences of PwP and/or caregivers, 2) treatment burden and 3) qualitative methods. A systematic search of the literature was then conducted on five electronic databases: MEDLINE, Embase, CINAHL, Psycinfo and Scopus. The full search strategy and search terms used for each database are included in Appendix D (page 313).

Table 13: PICOS framework search strategy

PICOS Elements	Description
Population	People with Parkinson's (PwP) aged >18 years old Caregivers of PwP aged >18 years old
Intervention	Experiences of usual treatment in any care setting: - home, care home, hospital, community, outpatient clinics, rehabilitation
Comparison	Not applicable
Outcome	Treatment Burden
Study Design	Qualitative studies or mixed-method studies with a qualitative component

3.2.2 Inclusion and Exclusion Criteria

Studies were included if they involved adult participants (aged >18 years) who were diagnosed with PD and/or were caregivers of people with PD. Studies that involved participants affected by PD and also other LTCs (such as Alzheimer's dementia) were only included if the findings reported relevant data from PwP and/or caregivers independently from participants with other LTCs. This was to ensure that data included in this review were exclusive to the experiences of PwP and/or caregivers of people with PD. To enable an in-depth understanding of participants' experiences and views, the inclusion criteria were limited to studies that conducted qualitative methods such as interviews, focus groups or observations and qualitative analysis. Mixed-method studies with a qualitative component that presented qualitative data were also included. Quantitative studies such as RCTs, cohort studies, questionnaires or surveys that did not report qualitative data were excluded. Studies were included if they reported experiences of PwP and/or caregivers of usual treatment or management in any care setting such as home, care homes (nursing and residential home), hospital, community, outpatient clinics or rehabilitation. Studies that reported qualitative data that did not relate to the usual treatment or management of PD such as experimental studies or clinical trials were excluded. Studies published in peer-reviewed journals were included to increase the likelihood of included studies being of high quality. Grey literature such as conference abstracts or proceedings, book chapters, policy or technical reports, commentaries, and PhD theses were excluded. The summarised inclusion and exclusion criteria for this systematic review are shown in Table 14 (page 110).

Table 14: Inclusion and exclusion criteria for articles found

Inclusion criteria	Exclusion criteria
Participants aged >18 years old	Participants aged <18 years old
Data that reported experiences of PwP and/or caregivers with PD independently of other health conditions	Data reported that were not exclusive to the experiences of PwP and/or caregivers with PD
Qualitative methods and/or mixed-method studies with a qualitative component	Quantitative methods
Qualitative data related to usual care	Qualitative data related to experimental studies or clinical trials
Studies published in peer-reviewed journals	Grey literature

No geographical limitations were applied in this systematic review. This enabled us to gain a broader understanding of the experiences of PwP and caregivers across various countries and healthcare systems around the world. The search was limited to papers published from the year 2006 as this was the year that the first NICE guideline for PD was introduced in the UK(20). This also allowed us to understand the impact of current healthcare systems on the treatment burden(103, 176). Due to the lack of available translation services, non-English (French, Portuguese, German, Norwegian, Spanish, Persian, Japanese) full-text articles (N=13) were excluded following full-text screening.

3.2.3 Data Screening

Rayyan, a freely available web and mobile app was used for the screening of papers after the searches were conducted and following the removal of any duplicates(256). Rayyan was specifically designed to expedite title and abstract screening during systematic reviews. As systematic reviews are a collaborative process, it was easy to collaborate with other reviewers using Rayyan. Each stage of screening can be conducted blinded and independently by each reviewer. Following completion of screening, results can be unblinded to allow discussion of any resulting conflicts between reviewers.

Screening of article titles for relevance was conducted by me individually. Other researchers who assisted with this systematic review were members of the Academic Geriatric Medicine research group at the University of Southampton (LC, NJC and SERL) as well as my supervisory team (HCR,

KI, SF) who all had experience in conducting systematic reviews. Screening of abstracts was conducted by me and a second reviewer (KI, LC and SF). Full-text screening was conducted by me and a second reviewer (NJC and SERL). Any disagreements following the independent screening of abstracts and full-text papers were discussed between me and the second reviewer to reach an agreement on the final included or excluded articles. The reasons for exclusion of any full-text articles were documented and presented in the PRISMA diagram (see Figure 11, page 115).

3.2.4 Data Extraction and Quality Appraisal

I used Microsoft Word software to extract data regarding study characteristics, participant details, and study settings using a pre-defined data extraction template (see Appendix E, page 319) created by myself and finalised following discussion with my supervisory team. Data extraction on treatment burden in PD was conducted independently by me and one of my supervisors (KI), who is an expert in qualitative research. We then compared and discussed the extracted data to ensure all experiences related to the treatment burden in PD were included. Data were extracted from the findings or results section of the included articles as the discussion and conclusion sections would likely not present any new primary data, only additional interpretations(257). Relevant data were extracted if they were quotations from participants (first-order construct) or interpretations of the authors (second-order construct).

The word 'burden' is defined by the Cambridge Dictionary as 'something difficult or unpleasant that you have to deal with or worry about'(258). Therefore, data extraction was limited to data that described the experiences of PwP and/or their caregivers related to looking after their health that were difficult or unpleasant, even if the term 'treatment burden' was not specifically mentioned. To capture all aspects of looking after their health with PD, this included experiences of any treatment, management, tasks, or interactions with healthcare services. Any challenges or stressors that exacerbate the burden and the impact of burden were extracted. As the focus of this review was on treatment burden experiences, we did not extract any data related to symptom burden or caregiver burden (the extent to which caregivers perceive that caregiving has had an adverse effect on their emotional, social, financial, physical and spiritual functioning) in PD that did not specifically relate to the workload of health. For example, experiences or views on how the symptoms and progression of PD have affected their activities of daily living were not extracted.

Quality appraisal was conducted by me and a second researcher (NJC) independently and answers were compared and discussed. The quality of studies was assessed using the Critical Appraisal Skill

Programme (CASP) criteria for qualitative studies which consists of ten questions that consider the appropriateness of the research methods and whether the study findings are well-presented and meaningful(181). The CASP is a well-established tool used to assess the methodological rigour of qualitative studies (see Section 2.6.3.2, page 83). Questions with 'Yes' responses were scored one point to give an overall quality score for each study.

3.2.5 Data Synthesis

Data synthesis using framework synthesis guided by Eton's framework of treatment burden was led by me with close supervision by my supervisors(74). Briefly, Eton's framework was developed with patients with multimorbidity other than PD and therefore considered suitable for this study as PwP can be considered an exemplar for patients with multimorbidity (see Section 1.6.2, page 48). Framework synthesis has five stages: 1) familiarization with the literature, 2) identification of a thematic framework (Eton's framework in this review), 3) indexing: applying the framework to code the extracted data from individual studies included in the review, 4) charting: creating charts with distilled summaries from the evidence and 5) mapping and interpretation.

To familiarise myself with the data, I first read each full-text article to understand the primary aim and context of each study. I then read and re-read the extracted data regarding treatment burden from each article. Data were also organised and read according to first- and second-order constructs to understand the experiences of treatment burden of PwP and caregivers. Data extracted from each study were thematically coded and these codes were then mapped against the three main themes of Eton's framework and their sub-themes to create charts with distilled summaries from the evidence. The three main themes of Eton's framework are: 1) the work patients must do to care for their health, 2) challenges and stressors that exacerbate felt burden and 3) the impacts of burden(74). I was careful to code the extracted data text whilst keeping an open mind to identify themes or concepts in the data that may not be described by Eton's framework. The charts were then used to map the range and nature of aspects related to treatment burden in PwP and their caregivers and to find associations between the themes. Although Eton's framework was useful in the initial stages of coding and analysis, further analytical interpretation of the data using a flexible and inductive approach was undertaken to define new themes of treatment burden that may be interlinked within the data.

3.2.6 Reflexivity

I had no experience conducting qualitative research prior to this systematic review. As previously discussed in see Section 2.2 (page 67), there are differences in the research paradigms between quantitative and qualitative methodology. My clinical training and research experiences to date meant that I have had more exposure to the positivist research paradigms, which believe there is only one truth and that explanation of a phenomenon can be reached using empirical methods and quantitative methodologies. It was therefore difficult at the beginning of the review to move towards a more constructivist approach with a qualitative lens. However, I tried to alleviate this by ensuring that I fully immersed myself in the data to understand the experiences of PwP and caregivers and ensure accurate interpretation of the data with close supervision from my supervisors throughout.

Data extraction was a challenging process in this review as none of the studies aimed to explore the treatment burden of PwP and caregivers. It was at times difficult to decide whether the findings presented in each article were specifically related to the treatment and management of PD rather than related to the illness or symptoms of PD or caregiver burden (which were specifically excluded from data extraction). This was similar to the experiences of Gallacher et al who conducted qualitative systematic reviews of patient experiences of treatment burden in stroke, heart failure and diabetes(176). Using the pre-defined data extraction template which contained specific inclusion and exclusion criteria was helpful during the data extraction process to try and mitigate this challenge. Furthermore, my supervisor (KI) and I conducted data extraction independently and discussed any discrepancies before reaching a consensus. This process helped increase rigour as well as ensure that all data related to treatment burden were included. Prior knowledge of Eton's framework may have influenced data extraction and data analysis, even though I was careful to maintain an open mind during coding to identify any data that did not fit into Eton's framework. Furthermore, as described in Section 2.10 (page 103), my role as a clinician may have influenced data analysis. Multiple discussions were held with my supervisors during data analysis to reduce these biases and ensure an inductive approach and interpretation of the data beyond Eton's framework to achieve the aim of the review. The overall findings were then discussed within the systematic review team with a range of clinical and research experiences to reach a consensus.

3.3 Findings

3.3.1 Included Articles

The number of articles screened, assessed for eligibility, and included in this systematic review are presented in the PRISMA flow diagram (see Figure 11, page 115). An initial 4466 articles were identified from five databases. After the removal of duplications, a total of 1757 articles were identified. Following title screening, 302 titles and abstracts were screened. 115 full-text articles were then assessed for eligibility. Two qualitative systematic review articles were subsequently excluded following full-text review as the primary qualitative studies that contained relevant data on treatment burden in PD were already identified by our search and included in this systematic review. A final 39 articles were included in this review. A summary of the included articles is shown in Appendix F (page 321).

There were a total of 933 participants: 413 PwP, 435 caregivers and a further 85 participants where it was unclear whether they were PwP or caregivers. The included participants in the studies were PwP or their proxies (N =7), caregivers (N=16) or both PwP and caregivers (N=16). Studies from articles included in this review were conducted in multiple countries including: UK (N=10), USA (N=8), Canada (N=3), Denmark (N=3), Netherlands (N=3), Australia (N=2), Brazil, (N=1), Ethiopia (N=1), Greece (N=1), Indonesia (N=1), Iran (N=1), Ireland (N=1), New Zealand (NZ) (N=1), Singapore (N=1) and Tanzania (N=1). One international study was conducted across seven countries in different continents (Czech Republic, Italy, Netherlands, Norway, NZ, Spain, and UK). The qualitative methods used in the studies were interviews (N=29), focus groups (N=3), or both interviews and focus groups (N=3). One study conducted secondary data analysis of interviews, one study conducted participant observation and interviews, one study conducted repertory grid methodology and one study conducted a qualitative survey questionnaire.

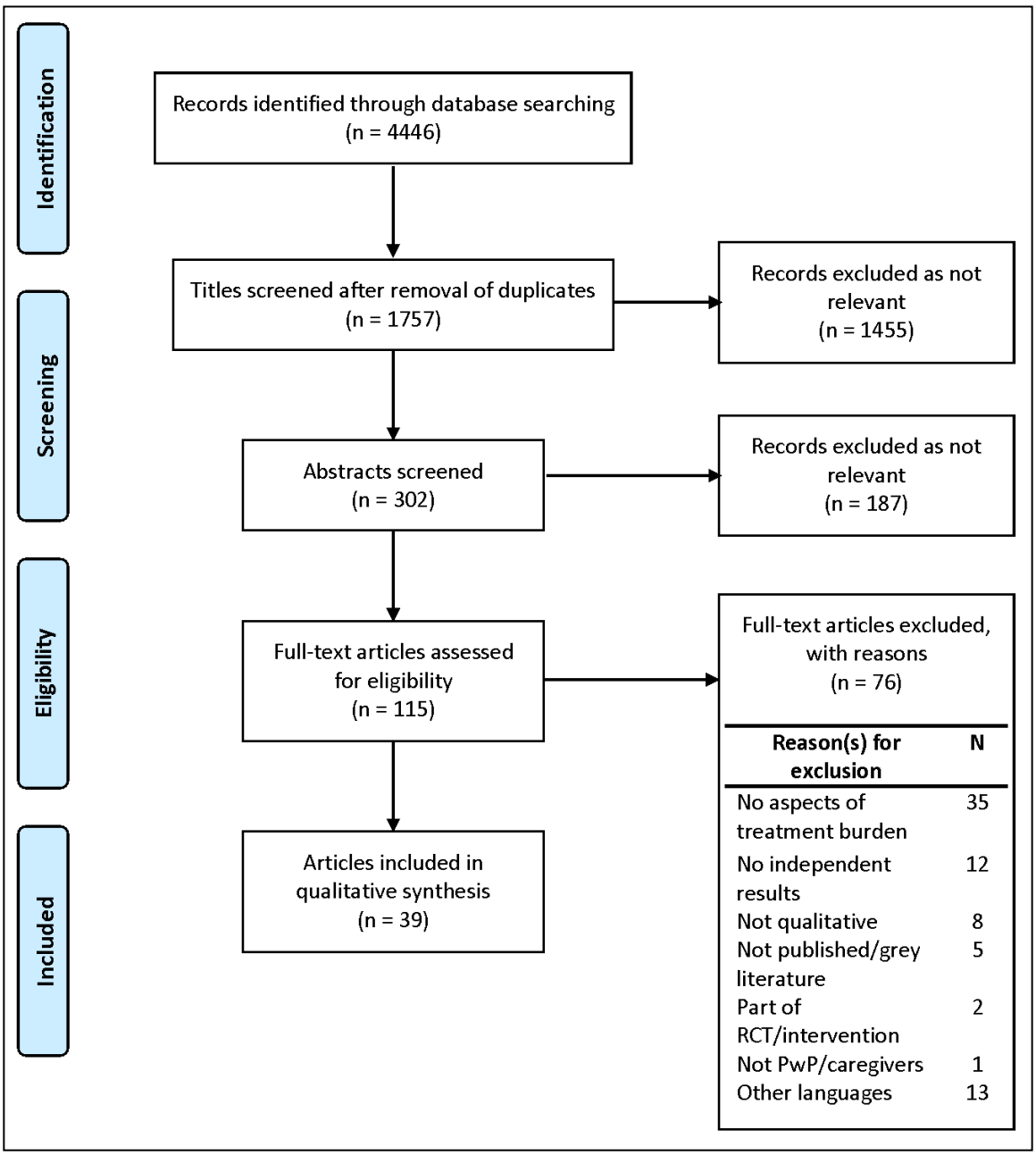


Figure 11: PRISMA flow diagram

3.3.2 Quality Appraisal

Most articles (N=34/39) were of good quality and scored seven or more points using the CASP qualitative appraisal tool (see Appendix G, page 329). All 39 articles included a clear statement of the aims of the research and the use of qualitative methodology was appropriate. Understanding the treatment burden in PD was not the primary aim of any of the included studies. The majority (N=29/39) of studies failed to explore the potential biases and influences of the researcher-participant relationships in the articles. As there is no consensus on assessing the quality of qualitative research, no studies were excluded based on quality.

3.4 Treatment Burden Experiences in Parkinson's Disease

Data synthesis supports the use of Eton's framework of treatment burden in identifying the treatment burden experiences of PwP and their caregivers. These findings are summarised in Table 15. The subthemes within each of the three main themes from Eton's framework are ordered in Table 15 based on the subthemes with the highest number of codes.

Table 15: Treatment Burden Experiences of people with Parkinson's and Caregivers

Eton's Framework of Treatment Burden		**Treatment Burden Experiences of PwP and Caregivers**
Theme	**Subtheme (N= Number of codes)**	
Work patients must do to care for their health	Medications (N = 40)	Multiple medications with frequent adjustment of medication doses and timing; use of pill devices; plan and schedule medication timings around daily activities; manage diet and medication; dependence on PD medication
	Medical appointments (N = 15)	Organise and attend regular medical appointments with multiple healthcare professionals
	Learn about conditions and care (N = 11)	Learn about PD, progression of PD and other health conditions; learn about medications and medication side-effects; learn about available resources and services
	Health behaviours (N = 10)	Diet; exercise; supplements
	Monitoring health status (N = 7)	Monitor response to PD medications; monitor other chronic medical conditions
	Medical Devices – Deep Brain Stimulation (N = 5)	Adjustment of deep brain stimulation settings following implantation
Challenges or stressors that exacerbate felt burden	Challenges with taking medication (N = 36)	Challenges with medication adherence; fluctuation of PD medication efficacy with wearing-off of medication effectiveness; progression of PD symptom; precise timing of PD medications; medication side-effects

	Healthcare provider obstacles – system issues (N = 32)	Lack of care coordination and continuity of care between services; inflexible organisational structures of health and social care systems; poor availability and lack of access to healthcare and social services; poor service provision for severe PD; challenges faced in care home or hospital settings
	Confusion about medical information (N = 28)	Poor information provision (lack of information, too much information and/or contradicting information) regarding PD, prognosis with PD, medications, and available services
	Healthcare provider obstacles – individual provider issues (N = 18)	Lack of patient-centred care; poor relationships and unsatisfactory interactions with healthcare professionals
	Financial challenges (N = 13)	Cost of travel, appointments, medications, potential loss of financial income and lack of insurance coverage; personal payments due to lack of financial support and delays from health and social care support
	Barriers to self-care (N = 10)	Difficulty with travel and transportation; other chronic medical problems; lack of certainty on how to manage PD
	Interpersonal challenges (N = 4)	Frustration at loss of independence; challenging relationships between PwP and caregiver
Impacts of burden	Role and social activity limitations (N = 16)	Change in life role and responsibilities; impact on planning and attending social activities
	Physical and mental exhaustions of self-care (N = 10)	Physical and mental exhaustion completing the workload of health; uncertainty of managing health and making decisions regarding health

It was clear from the data that there were several important recurring issues reported by PwP and their caregivers concerning the workload of healthcare with PD and the challenges that exacerbate this workload. These issues of treatment burden were closely interlinked between the themes and subthemes described in Eton's framework. We found that the main issues of treatment burden experienced by both PwP and caregivers are associated with: 1) managing the medication workload despite the challenges, 2) learning about health and issues getting the right information and 3) healthcare obstacles at individual and system-level due to difficulties

attending healthcare appointments, interactions with healthcare professionals and challenges with the healthcare system.

Other aspects of treatment burden in PD include financial challenges, the impact of other LTCs, lifestyle changes such as diet and exercise, and the workload of managing DBS treatment. Consequently, PwP and caregivers described how the workload and challenges of the treatment burden impact their lives and led to physical and mental exhaustion of self-care and limitations on their role and social activities. The experiences of treatment burden with supportive quotes from PwP, caregivers, or authors' interpretations from the included articles are presented below.

3.4.1 Managing the medication workload despite the challenges

Issues related to medications including managing the workload of medications and the challenges associated with taking medications in PD were frequently mentioned in the literature. This theme has seven subthemes (Figure 12): 1) complexity of medication regimes in PD, 2) balancing the benefits and side-effects of PD medications, 3) constant planning and scheduling of activities around medications, 4) the unpredictability of PD medication efficacy and symptoms, 5) attitudes towards medication changes, 6) issues with medication adherence and 7) dependence on medications.

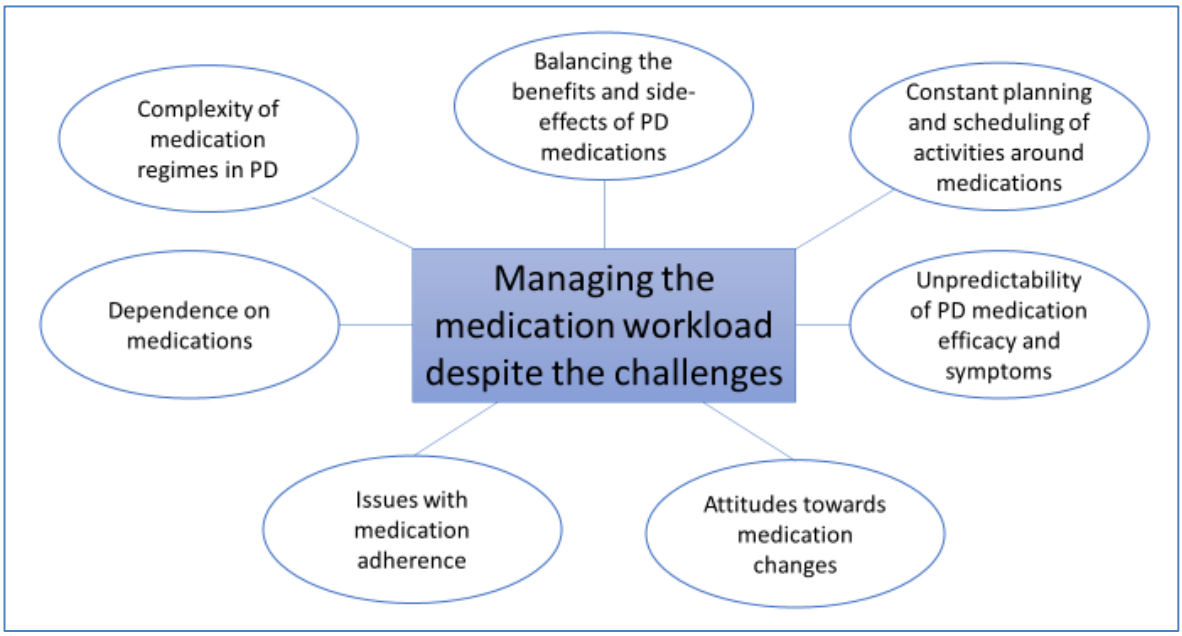


Figure 12: Managing the medication workload despite the challenges

3.4.1.1 Complexity of medication regimes in PD

One of the main issues of treatment burden reported by PwP and caregivers related to the task of managing PD medications. PwP reported taking numerous medications at multiple times throughout the day to manage their health with PD. Furthermore, they reported managing frequent changes in medication doses and timings to find the optimal medication regime that may help alleviate their symptoms(259-265).

> *"The medication has only recently started working. It's taken a long time to get the dosage right. I am now more myself."[PwP](263)*

Similarly, helping with the task of taking medications was a vital aspect for caregivers of PwP(133, 259, 262, 266, 267).

> *"The women all took on a role in relation to the administration of medicine. Close observation of the partners' condition was necessary to make the administration possible. The women therefore gave high priority to observation and medicine regulation." [Author](262)*

Caregivers of PwP with swallowing difficulties also reported that they had to be conscious of the different methods to administer medications to the person with PD during mealtimes(268).

> *"These issues ranged from having difficulty swallowing pills that required taking medicines with applesauce, to being on a mechanically processed diet to being supervised by the spouse while eating." [Author](268)*

3.4.1.2 Balancing the benefits and side-effects of PD medications

It was challenging for PwP and caregivers to manage the side-effects of PD medications such as dry mouth, compulsive behaviour, hallucinations, disinhibition, impulsivity, drowsiness, frightening nightmares, and insomnia which can be troubling and embarrassing (263-265, 267, 269-271). PwP reported that other side-effects of PD medications such as drowsiness also hinders their daily activities(269). Moreover, some PwP also reported that the medications did not help their symptoms and instead made them feel worse(263, 269).

> *"It's horrendous (the medication). Made me feel worse. I worked on a switchboard then and I fell." [PwP](263)*

However, even though they had concerns about the potential long-term side-effects of dyskinesia with PD medications, PwP described taking medications as "the lesser of two evils", recognising the need for PD medications to help their symptoms(264).

3.4.1.3 Constant planning and scheduling of activities around medications

PwP and caregivers reported having to plan and schedule their activities around their medication timings to try and reduce the impact of PD symptoms on their daily lives. They established a daily routine around the times when medications were most effective(261, 264, 265, 269, 272). Ensuring that PD medications were taken at precise times was especially important if they had planned any social activities to avoid any embarrassment or distress as PwP did not want their symptoms to be seen by other people(261, 269).

> *"When we go shopping downtown, locally… I say to my husband, I don't want to go at noon, because it is medication time, and it takes some time before it works … I will stand there like a statue unable to move anywhere. People are looking strangely, they really are, and I don't like it." [PwP](261)*

PwP and caregivers reported planning their mealtimes and dietary requirements around PD medications and medication side-effects(132, 261, 264, 265, 269, 270, 272-274). They took careful consideration of this as they were aware of the potential drug and food interactions that may occur with PD medications(259, 264, 269, 273). For example, PwP had to adhere to instructions to take medications before and after meals as well as avoid protein-rich meals(264, 273).

> *"I'm an early person. I kick off at six o'clock in the morning. They say it should be after meals, before or after meals. I don't eat at six o'clock in the morning, but I'm in the need of 'em (the tablets). So I take two at six. Two more at ten, then at two." [PwP](269)*

PwP and caregivers also described planning and scheduling health and social activities such as clinical appointments, exercise, meeting family or friends and shopping around their medication timings(259-261, 265-267, 269).

> *"She had moved all her tablets forwards by 30 min to cover her outing to the clinic on the day that her interview was conducted." [Author](269)*

Nevertheless, the strict timings for PD medication were challenging for PwP and their caregivers. Some PwP and caregivers reported that the inflexible schedule of PD medications and short

intervals between medication timings interfered with their personal daily activities(261, 264, 265, 275).

> *"Taking medicines at short intervals limits the time for my personal activities." [PwP](265)*

3.4.1.4 The unpredictability of PD medication efficacy and symptoms

Despite the careful planning and scheduling around their medications, PwP and caregivers reported that the variability of PD medication effectiveness as well as the unpredictability and fluctuating symptoms of PD on a daily basis added to their challenges with managing medications(264, 267, 269, 270, 276). PwP reported that the lack of PD medication efficacy consequently led to the increasing symptoms of PD such as visible tremors which caused them to worry that the medications were not working(269).

> *"I'm worried about the tremors. They're very visible. If I'm standing or walking to the supermarket, it's very obvious. I'm concerned the medication is not doing what it's supposed to be doing." [PwP](269)*

Furthermore, PwP also described the 'wearing off' effect of PD medications as the medication effectiveness declines before the next dose is due, resulting in poor symptom control(265, 269, 270, 272). They were aware of how long the positive effect of medications lasted and could anticipate the return of their symptoms, which was a reminder that their next medication dose was due(272). Accordingly, there were changes in medication timings and doses, at times on a 'trial and error' basis, which may potentially cause considerable confusion regarding medications(267).

> *"I usually get about five, six hours out of one lot of medication, it only lasts about four now, I can feel it wearing off so then I'm sort of just hanging around as long as I can before I take the other one, and then within about half an hour I'm back, I'm fairly good then." [PwP](272)*

3.4.1.5 Attitudes towards medication changes

There were two contrasting attitudes by PwP with adjustments in their PD medication doses and timings. Some PwP reported being more comfortable with self-managing their own medication changes and reported taking extra doses or changing their medication times to manage their symptoms around their work or daily activities(264, 269, 272). For example, a patient with PD

who was concerned about losing his job took extra efforts to plan his medication doses and timing as well as admitted to taking extra doses to be able to function effectively and safely at work(269).

> *"He drove to work before the tablets 'kicked in' so they would be optimally effective by the time his shift started." [Author](269)*

In contrast, other PwP preferred to be led by healthcare professionals and were resistant to any self-initiated changes in medications and only deviated from their medication regimens after seeking advice from healthcare professionals(269). Despite suffering side-effects from the medications and concerns from their caregivers, some PwP even persisted with their medications as advised until their next appointment with the PD specialist(269).

> *"I phone the nurse (PD specialist nurse) and she says ''Take an extra two.'' I always phone her." [PwP](269)*

PwP and caregivers monitored the response to PD medications following changes to medication doses and timings as well as monitored how the symptoms of PD were affected by other factors such as diet, sleep and exercise(262, 264, 266, 267).

> *"We've tried really meticulously to correlate things like diet, frequency of medication, dose of medication, should she take one whole pill every two hours or a half pill every hour, that kind of stuff. We have experimented with that stuff six ways from Sunday, diet, sleep, exercise." [Caregiver](266)*

3.4.1.6 Issues with medication adherence

Even though they recognised the importance of PD medications in helping to manage their PD symptoms, PwP and caregivers reported issues with adherence to PD medications. For example, the lack of positive symptom response observed by PwP was reported as a reason for poor medication adherence, even though their family members did not notice this lack of response(264).

> *"Participants indicated that it was challenging to remain adherent to medications when they did not notice a positive response from the medications. One participant revealed that he did not notice any differences or effects after taking antiparkinsonian medications. However, his family members noticed differences when he took the medication." [Author](264)*

Both PwP and caregivers reported that other reasons for poor medication adherence were simply forgetting to take medications, confusion about which medications were due or being occupied with work or social commitments(261, 264, 269, 274).

> *"The biggest challenge for me is remembering to take my dose in the middle of the day. I keep a little vial at work with the medications in there, and sometimes it runs out, so I have to leave work and I gotta come home and I gotta pick up my medications and then go back to work." [PwP](264)*

Due to the number of medications and complex medication regimens, some PwP reported that they used pill boxes or portable pill carriers to help remind themselves to take their medications and ensure medication adherence(264, 270).

> *"I have a pill box and I get up in the morning and I take out all the pills that I need to take that day and put it in the pill box. I also keep track that way of whether I missed a dose or not." [PwP](264)*

Caregivers also had an important role in ensuring medication adherence by helping to manage and administer medications as well as reminding them when their medications when due(133, 259, 262, 266, 267).

> *"My husband can't remember any longer if he has taken his medicine and I know how important it is, so I've quite simply developed a system with different coloured egg boxes and an alarm clock." [Caregiver](262)*

Some caregivers occasionally reported that they felt frustrated at the attitude of the person with PD they cared for and could not understand why they would not adhere to the medications or dietary recommendations(262, 277).

> *"For a long time my husband would not admit that he was sick and therefore refused to take his medicine. I couldn't understand it, because his job was under threat due to the symptoms and the medicine would help." [Caregiver](262)*

3.4.1.7 Dependence on medications

Ultimately, PwP and caregivers described that living with PD meant being dependent on medications(261, 264, 266, 269). One patient with PD even described prioritising their PD medications even in the event of a fire(265).

"…if there was a fire in my house I would go for my pills."' [PwP](265)

Additionally, as PD progressed, their dependence on medication increased with shorter time intervals between medications and increasing medication frequency(261, 272).

3.4.2 Learning about health and issues getting the right information

Another main issue of treatment burden experienced by PwP and caregivers relate to learning about their health and issues getting the right information on how to best manage their health with PD. The subthemes in this theme (see Figure 13) are: 1) learning about PD, medications, and services, 2) lack of adequate information at the right level, and 3) uncertainty and conflicting information.

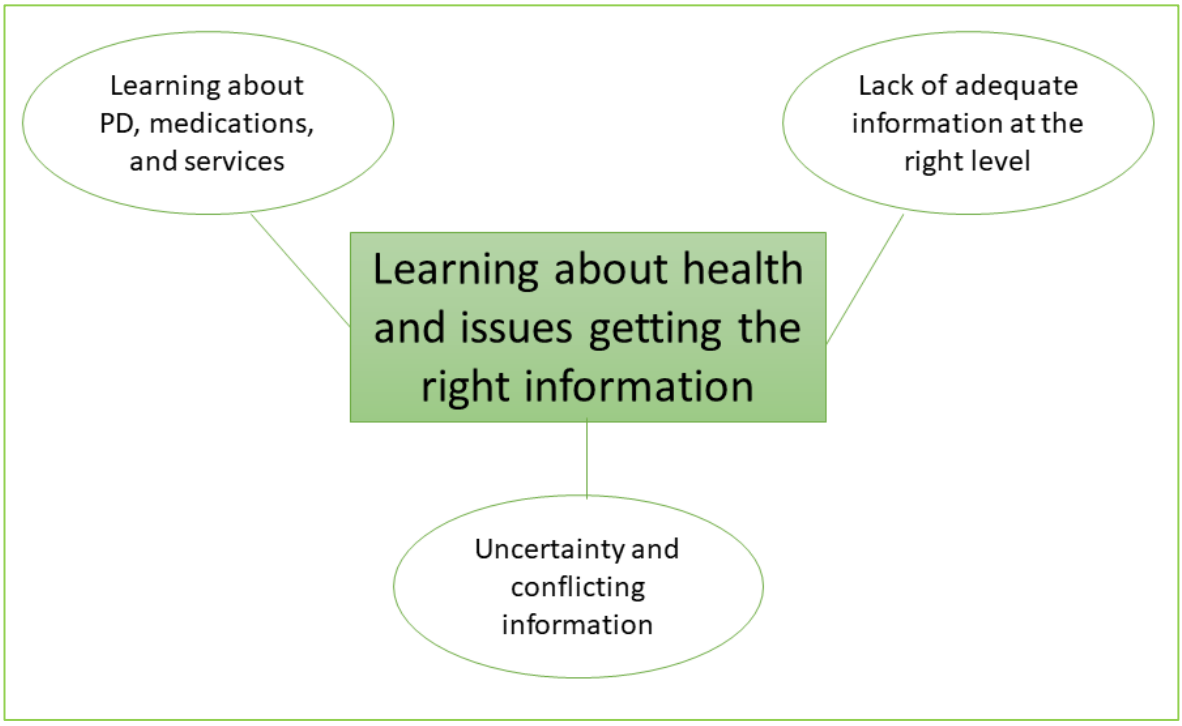


Figure 13: Learning about health and issues getting the right information

3.4.2.1 Learning about PD, medications, and services

After being diagnosed with PD, PwP and caregivers reported learning about the disease, how it progressed, other health issues related to PD and the available resources and services(132, 259,

278). They also learnt how PD medications work, which medications to take and the potential medication side-effects(262, 264, 271). PwP and caregivers obtained information from various sources such as healthcare professionals, searching the internet, reading research articles and attending PD support groups(133, 264).

> *"Yes we would use the internet a good bit and also there are a lot of leaflets that they [Parkinson's UK] publish." [PwP](133)*

PwP and caregivers reported searching for information themselves from the internet, other people affected by PD or support groups due to a lack of information provided to them regarding PD(133, 265, 269, 279). Caregivers specifically sought information about PD as they reported that it helped them manage the complex caregiving role and reduced their anxiety of looking after someone with PD(259).

> *"The strategy of seeking knowledge about the illness was also common in order to mitigate the anxiety of this type of complex caregiving. Caregivers also sought to learn about resources that could provide them respite opportunities." [Author](259)*

3.4.2.2 Lack of adequate information at the right level

Despite the importance of information provision, PwP and caregivers across different countries and healthcare systems reported receiving insufficient information from healthcare professionals on issues such as dietary requirements, managing the progression of PD and prognosis of PD(133, 262, 265, 267, 269, 271, 276, 278-281).

> *"There was an overall lack of information at diagnosis. Some participants were missing basic information about PD, even to know that it is incurable."[Author](280)*

Furthermore, some PwP and caregivers reported that some of the information they obtained was not relevant to their current situation and consequently caused distress and made them feel worse about living with PD(133, 263, 269, 279). Other PwP and caregivers actively chose not to search for information and avoided support groups as it reminded them of their inevitable deterioration with PD(269).

> *"Due to a lack of information from their doctor, one family turned to the Internet for help. In the end, they were "shocked" and saw the Internet as unhelpful and*

> *a "mistake" and they decided that they would advise others to not repeat the same mistake." [Author](279)*

Some PwP and caregivers also reported that they were unable to prepare for the advanced illness, plan for the future or make decisions about their health due to the lack of information regarding the progression and poor prognosis of PD(133, 268, 271, 280).

> *"This lack of prognostic information resulted in many of the couples not making any plans or decision relative to the future. More than half of the couples had no plans in place relative to advance directives, wills or any other legal documents or power of attorney for healthcare." [Author](268)*

Across multiple countries including Canada, Denmark, Ireland, Netherlands, Norway, Spain and UK, PwP and caregivers reported that there was a lack of information and signposting on the relevant healthcare and social services or support available to them(133, 262, 265, 267, 279, 280, 282, 283). Some reported finding out about the available services only by chance(133, 265).

> *"All patients and relatives agreed that it is not easy to find out what kind of help you can get. One of the patients learned on the focus group that he was in title to get physiotherapy for free, he had Parkinson's for 3 years and nobody told him!" [Caregiver](265)*

This lack of information meant that some PwP and caregivers were unable to access and obtain help from the appropriate services such as physiotherapists, occupational therapists or speech and language therapists, even though it may be beneficial to them(133, 265, 282, 283).

3.4.2.3 Uncertainty and conflicting information

Caregivers reported being uncertain whether the symptoms of the person they cared for related to PD or a consequence of medication side-effects(267). Some caregivers described feeling responsible for searching any required information on their own due to the lack of regular appointments and contact with healthcare professionals(278).

> *"Caregivers often attempted to gain understanding and search for information themselves before approaching professionals involved in their partner's care. They described feeling responsible for finding out about psychotic symptoms themselves because they did not have regular contact with professionals." [Author](278)*

They did not know what changes in health circumstances would require them to ask for help outside of their routine healthcare appointments(267). Caregivers also commented that they felt unprepared and were unsure about what to do during emergency situations such as falls, resuscitation and psychosis due to the lack of information provided by healthcare professionals(271, 280).

> *"I found it difficult making the right call, whether to call the doctor or to take him in (to hospital), judging whether he was going to be ok, things like that." [Caregiver](280)*

Furthermore, PwP and caregivers also described contradicting information from different healthcare professionals causing confusion about medical information provided to them and occasionally feeling like they have been sent from "pillar to post"(263, 264, 280, 283).

> *"The diabetic nurse says she would like to change things but the consultant says no, leave it as it is." [PwP](263)*

3.4.3 Difficulties attending healthcare appointments and interactions with healthcare professionals

Organising and attending healthcare appointments whilst living with PD is another identified main issue of treatment burden in PD. Yet, the challenges that exacerbate this treatment burden experiences described by PwP and caregivers are explored in the following subthemes (see Figure 14, page 128): 1) time and travel to healthcare appointments, 2) the forgotten role of caregivers at appointments, and 3) unsatisfactory interactions with healthcare professionals.

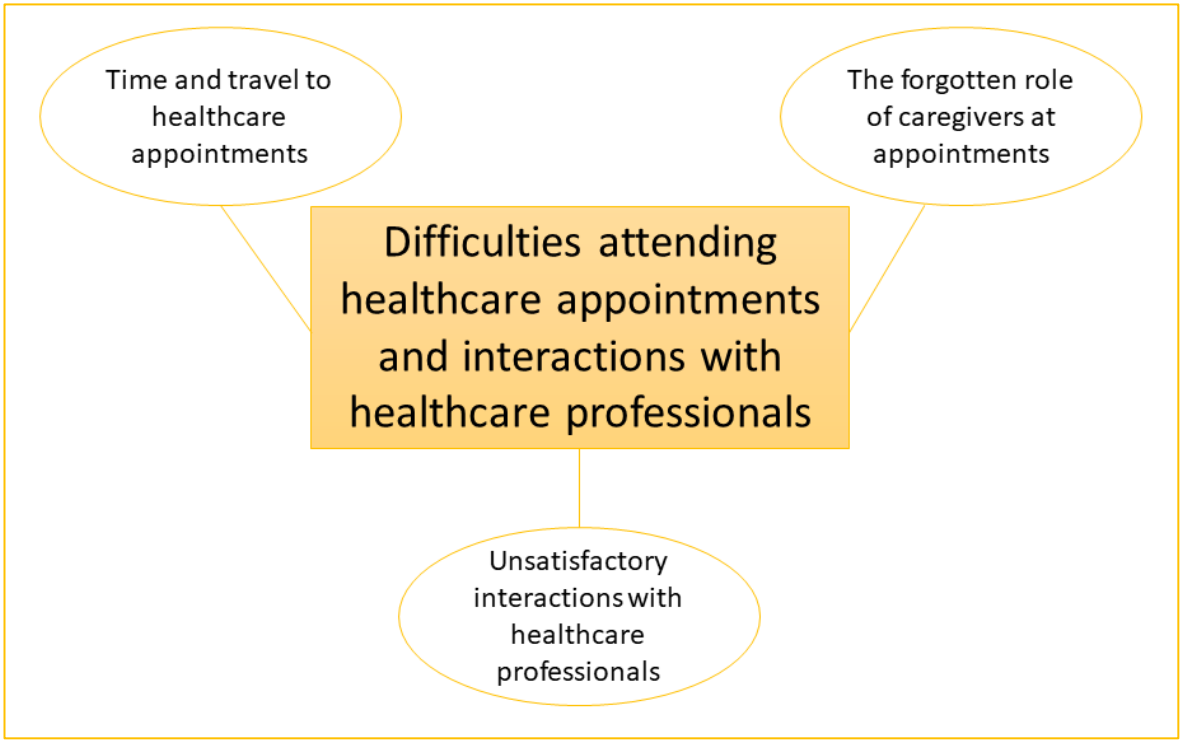


Figure 14: Difficulties attending healthcare appointments with healthcare professionals

3.4.3.1 Time and travel to multiple healthcare appointments

PwP and caregivers reported that they had to attend regular healthcare appointments with doctors (GP and PD specialist), PD nurse specialists or physiotherapists(133, 259, 263, 266, 267, 270, 277, 284-287). Some described the additional time required to prepare for and travel to appointments, despite the short distances of clinics from their house(265, 285, 287).

> *"Preparation for things such as a medical appointment presented inordinate difficulties. Time was an issue, as expressed by this caregiver, "He can take up to two hours so what I do now to avoid irritation I tell him two hours before we need to go to get ready."" [Author and caregiver](287)*

Others described issues faced with transportation to healthcare appointments. For example, PwP and caregivers reported how person with PD may struggle with getting in and out of the car particularly as PD progressed(132, 285, 287)

> *"I can't get to the hospital, because of setting it all up. The size of the car, couldn't get in the taxi because it had seats, where they take the ramps up and sit there." [PwP](132)*

3.4.3.2 Forgotten role of caregivers at healthcare appointments

Caregivers reported attending healthcare appointments alongside the person with PD as they were concerned that the person with PD may not remember the outcomes of the consultation and may forget to mention certain things during the consultation(266). However, despite playing an active role in helping the person with PD and managing the everyday consequences of PD, caregivers felt that their views and opinions were not considered during healthcare appointments(262, 266, 271).

> *"My husband sat in the outpatients with the doctor and told how it was going really well and that he didn't have any side-effects from the medicine. I thought that the doctor must surely know that PD patients often have a memory like a sieve. The doctor didn't ask how I thought it was going." [Caregiver](262)*

Some caregivers even described that they felt that they could not challenge or question the advice given by doctors due to the fear of being reproached, even if they did not fully understand the reasoning(279).

> *"While she wanted to know this information, she was reluctant to ask for it due to the fear of being reprimanded. She was concerned that they gave her spouse medication without telling her and him "what the side effects are.""*
> *[Author](279)*

3.4.3.3 Unsatisfactory interactions with healthcare professionals

PwP and caregivers in countries across different global regions such as the UK, Netherlands and Indonesia described a lack of patient-centred care from many healthcare professionals(265, 267, 277, 280, 282, 283). They reported that healthcare professionals predominantly focused on medication needs, rather than adopting a more holistic approach to consider their social, psychological and care needs, which may be more challenging for them(265, 267, 277, 280, 282, 283).

> *"Many participants perceived that their doctor was only interested in their medication needs, overlooking social and psychological needs which were often more distressing." [Author](280)*

In the UK, PwP and caregivers described poor relationships and interactions with healthcare professionals during their appointment as they felt that there was inadequate consultation time

to manage all their concerns, as well as infrequent follow-up appointments(133, 282). PwP and caregivers described how they felt 'alone' when managing their PD due to the lack of contact with healthcare professionals(280).

> *"When they did meet, the quality of the interaction between the specialist, patient and carer was variable with meetings brief, focusing on medication, with little or no psychological support or signposting to other types of services." [Author](282)*

Moreover, the predominant management of PD by neurologists or geriatricians in the UK meant that PwP and caregivers felt that their GP lacked detailed knowledge about PD, although they recognised that their GP still had a vital role in their overall health(133, 267, 282). Some caregivers also reported how they felt that the lack of knowledge of PD by both health and social care professionals meant the health of the PwP may be negatively impacted(282).

> *"Some carers gave examples of a lack of awareness and detailed knowledge of the disease among health and social care professionals including GPs." [Author](282)*

In Australia, PwP described a delay in medication changes and management of their PD due to the reluctance of their GPs to alter prescriptions without input from their PD specialist(270).

> *"While rural GPs willingly provided prescriptions, they seemed reluctant to adjust medication doses. Hence, dosage manipulation was often delayed by 6 to 12 months while PwP waited for a neurologist's appointment." [Author](270)*

3.4.4 Challenges with the healthcare system

Another main issue of treatment burden experienced by PwP and caregivers whilst organising and attending healthcare appointment include the challenges faced when navigating the healthcare system with PD. The subthemes in this theme (see Figure 15, page 131) include: 1) lack of care coordination between services, 2) lack of availability and poor access to services, 3) inflexible organisational structures and 4) experiences in care home or hospital settings.

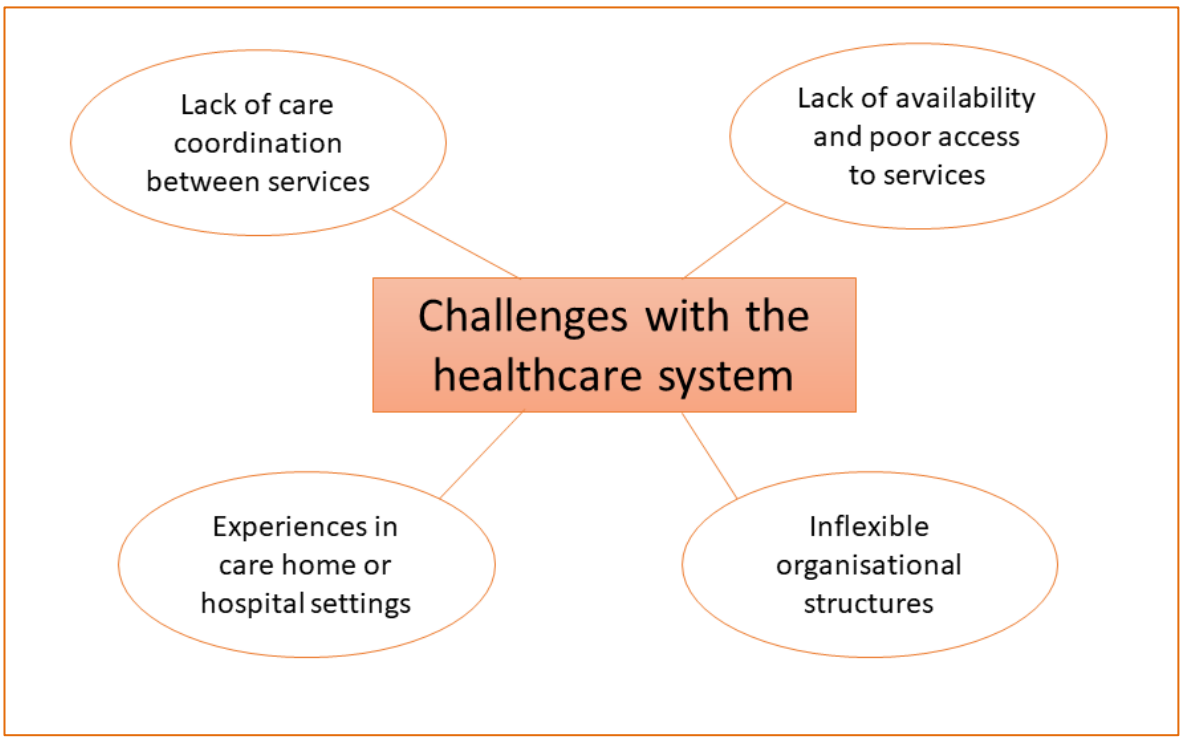


Figure 15: Challenges with the healthcare system

3.4.4.1 Lack of care coordination between services

On top of the issues with attending healthcare appointments described in the previous section, PwP and caregivers reported that attending appointments with multiple healthcare professionals that all focused on different health issues was challenging(132, 267, 281). PwP and caregivers described how it was at times difficult to ascertain whether a particular symptom was related to PD or other health conditions. Due to this uncertainty, they described that healthcare professionals tend to "pass the buck to each other" instead of managing their symptoms(267).

> *"…we still have checks with the cancer specialist every six months, we ask about the tiredness which really came on with a vengeance with the radiotherapy, and they're not sure really whether he's still tired because of that, or whether it's the Parkinson's. To be honest with you they all seem to pass the buck to each other." [Caregiver](267)*

PwP and caregivers in studies conducted in Ireland, UK, Singapore and Netherlands reported a lack of care coordination, continuity of care and cohesion between the different health and social care services(132, 133, 263, 267, 280-282, 285).

> *"Trying to coordinate doctor, doctors, nurse, neurologist. All working on different things. A second thing I'd change would be trying to see the same doctor twice. All a bit disjointed. Like a jigsaw." [PwP](132)*

Other PwP and caregivers described having to act as the middle person between services due to the lack of coordination and communication(282).

> *". . . it was frustrating, very frustrating because you were the liaison with the health people, with the GP and you were at them to constantly to go back and say this is not working." [Caregiver](282)*

PwP and caregivers reported that there was no clear multidisciplinary approach and a lack of clarity over the roles of health and social care professionals involved in their care(263, 281, 282). At times, they experienced contradicting advice about what to do regarding their health as well as confusion about the available support services due to the poor cohesion between services(263, 280). Some caregivers also perceived that the lack of coordination between services resulted in inadequate monitoring of PD symptoms and medications(133).

> *"…yet delayed or irregular medical reviews with specialists, combined with the lack of a continued and coordinated approach between and across services appeared to have a negative impact on the person with Parkinson's and on the carers. For example, carers perceived that their relative's condition and medication were not adequately monitored, and this resulted in inadequate symptom management." [Author](133)*

PwP also described additional challenges to their care due to the lack of coordination between services such as attempting to get a prescription from their doctor yet struggling to book an appointment with their doctor(263).

> *"I cannot get a repeat prescription automatically and I need to see the doctor. Controversial as I can't get in to see the doctor." [PwP](263)*

3.4.4.2 Lack of availability and poor access to services

PwP and caregivers also experienced poor availability of health and social care services(133, 263, 267, 268, 270, 276, 277, 279-283, 287-289). PwP and caregivers living in Australia, Canada, Ireland and UK described a lack of access and long waiting times for PD specialist doctors and other allied health professionals such as physiotherapists, speech and language therapists, palliative care specialists or hospice services(267, 270, 276, 279, 280, 282).

> *"Carers described local variation in availability of support (e.g. Parkinson's nurse visits) and long waits for appointments to see physiotherapists and speech and language therapists." [Author](267)*

As PD progressed, the deteriorating mobility of the person with PD meant that PwP and caregivers experienced difficulty accessing healthcare and social services due to the limited availability of home visits from these services(132, 276). PwP reported being discharged from specialist PD clinics to community services and being reliant on their GP and PD nurse specialist to manage their symptoms once they were physically unable to attend healthcare appointments(132). Due to their physical difficulties, other PwP made the active decision not to attend clinics as they perceived that the limited positive outcomes from attending clinics did not have any justifiable benefits(132, 273).

> *"...and I begin to think well 'what's the point?' because I stay on the same medication. So long, and nothing's changed. Well I think there's just not anything else they can do." [PwP](132)*

PwP and caregivers also reported limited funding for home care support, home modifications and supportive equipment as well as poor access to social support(133, 267, 268, 279, 283, 287). In the UK, despite the publicly funded NHS, PwP and caregivers reported paying for private carers, respite services and purchasing their own supportive equipment due to the long waiting times for funding support(133).

> *"Many condemned the lengthy timeframe to obtain and access supportive equipment for people with PD. Consequently, this resulted in many carers paying privately for trained carers to assist with activities of daily living, equipment and respite relief, adding to the financial burden of caring." [Author](133)*

Similarly in Australia, PwP reported that the inequitable funding system and limited access to home modifications added to their frustration and financial burden(287). The lack of access to services can also contribute to the financial challenges of treatment burden in PD that is described later on in Section 3.4.5 (page 135).

3.4.4.3 Inflexible organisational structures

PwP and caregivers also described how the inflexible organisational structures of the healthcare systems influenced their interactions with health professionals and care providers(132, 276, 290). For example, PwP described waiting at home all day for home visits from their GPs, care providers

and supply deliveries with no precise timings and described how had an impact on their independence and everyday activities(132).

> *"They don't always turn up. And they don't give you precise times, so you're gonna have to stay here the whole day waiting for somebody to come and deliver something." [PwP](132)*

Other PwP living in some countries such as Greece that are in an economic crisis reported that the complicated bureaucratic process of their national healthcare system, restrictions on healthcare spending, and shortages of equipment in public hospitals meant that they experienced long delays and multiple hospitalisations for implantation of the DBS device(288). Similarly, care agency allocation of support workers based on geographical areas disrupted the continuity of care that was available and meant that PwP did not have visits from a regular support worker which therefore prevented relationship building(290).

> *"For a while, we had the same support worker come every day. We really liked Jacqueline. She just knew what to do. But the care agency changed. A computer system dictated where personal support workers go depending on how close they were to a number of clients. This meant that we had many people come here instead of just Jacqueline." [Caregiver](290)*

3.4.4.4 Experiences in care home or hospital settings

PwP and caregivers living in care home or hospital settings also reported specific challenges with looking after their health with PD, particularly related to medications(132, 270, 273, 274, 276). They described delays of medication changes for care home residents with PD due to the multiple systemic levels of healthcare administration as any changes in prescription were passed from the hospital specialist to the GP, to the pharmacy before finally being received at the care home for the person with PD(276).

> *"If a resident's prescription was changed at a hospital appointment with their specialist, it could take two weeks or more for the resident to receive the new regime as the documentation passed from hospital to GP, to community pharmacy and finally to the care home." [Author](276)*

PwP living in care homes or hospital settings also reported errors in medication instructions, delays in medication administration as well as a lack of awareness and knowledge from staff members regarding administrations of PD medications and the contraindications for specific drugs

including dietary requirements(132, 273, 274, 276). Due to the fixed schedules in care homes or hospitals, PwP and caregivers reported that they were unable to receive their PD medications at their usual recommended time(132, 270, 273).

> *"Such institutional inflexibility was also experienced in care homes where participants experienced that they had to 'fit in' to the routine for personal care, meals, drug rounds and even control of room lights or heating." [Author](132)*

This inflexibility led to a loss of autonomy that impacted their medication and meal schedules as well as their usual routine for personal care(132).

3.4.5 Financial challenges

PwP and caregivers reported financial challenges of looking after their health due to the costs of travel, healthcare appointments, medications and treatments(264, 267, 268, 270, 271, 289, 291, 292). These financial challenges were reported from PwP and caregivers living in multiple countries including Australia, Brazil, Ethiopia, Tanzania, UK and the USA with different healthcare systems. They expressed worries for their financial stability which may be worsened due to their potential loss of earnings following diagnosis of PD or having to care for someone with PD, as well as the need to consider other daily living expenses(264, 267, 268, 270, 271, 289, 291, 292). Furthermore, as PD progressed, the costs of private carers and the potential costs of care added to their financial concerns(133, 267).

> *"But even so, we must hold on with spending a little more to be able to handle paying everything, because we know that the burden of a house is very [...] water, electricity, and telephone, and more and more." [Caregiver](292)*

PwP and caregivers living in developed countries such as the USA that do not have a universal healthcare programme described the financial burden related to medications(264, 268, 271). Despite paying for medical health insurance, they reported experiencing further additional high costs for PD medications(264, 268, 271).

> *"You run into this problem now with insurance. With the insurance don't want to pay for his medication. The medication is too high. If the Parkinson's person does not get the medication, it hurts. My husband was very sick. He could not get his medication because the insurance refused to pay for it." [Caregiver](271)*

In studies conducted in Africa (Ethiopia and Tanzania), PwP and caregivers described a lack of medication supply, having to source medications themselves and then subsequently paying the high costs of medications(289, 291). They also reported that treatment decisions were made based on their ability to afford the treatment, rather than medical need(291).

3.4.6 Other Aspects of Treatment Burden in Parkinson's Disease

Other aspects of treatment burden reported by PwP and caregivers include the impact of other LTCs, lifestyle changes such as diet and exercise, and managing DBS. PwP and caregivers also described how other LTCs such as diabetes and arthritis impacted their ability to manage their health(132, 259, 267, 286, 293). For example, managing their diet or monitoring blood sugar levels due to their diabetes was challenging for PwP and caregivers(286, 293).

> *"And it's frustrating, because what is it gonna be like for him if he has diabetes and Parkinson's? And yet, at the same time, I feel, this poor guy, he's lost so much, you're going to take something that he enjoys, that piece of chocolate or whatever, away from him?" [Caregiver](286)*

Caregivers also described how their own physical and mental health conditions affected their ability to help care for the health of someone with PD(293).

> *"The caregivers themselves also reported health-related medical problems that interfered with their ability to continue with caregiving demands. These included recent knee surgery, a new diagnosis of breast cancer, joint pain, sleeplessness, and fatigue. Mental health complaints were also common and included feeling overwhelmed, depressed, and stressed related to conflict with family, finances, and work responsibilities." [Author](293)*

To preserve their level of function and prevent further physical deterioration, PwP attended exercise classes specific to PD even if they were uncertain of the positive effect of exercise(132, 259, 266, 267, 276, 277, 283, 286, 294). Following advice from healthcare professionals, PwP and caregivers also reported specific dietary requirements to prevent interactions with PD medications or increase their intake of fruits to help digestion(259, 266, 277).

> *"Several of the participants at stage 4 described their focus on maintenance of current functioning and prevention of further decline by ensuring a healthy diet and attending singing and exercise classes arranged by local multidisciplinary centres offering Parkinson's specific facilities and courses." [Author](132)*

PwP with DBS implantation reported that the process of achieving the right level of stimulation settings together with changes in their PD medication dosages was a lengthy process which required them to attend multiple hospital appointments(260, 288).

> *"It has been going very slowly and that's hard when you are impatient, having to wait for a whole week to see what the adjustment did. And then having a new adjustment and then wait another week. It has been like that for six or seven weeks." [PwP](260)*

This period of constant monitoring and waiting to see if any adjustments to their DBS device settings had worked and any malfunction in their device reminded PwP of their illness with PD and kept them from engaging in any new activities(260). In some PwP, symptoms that were supposed to be helped by DBS unfortunately returned or sometimes worsened which then led to increased financial burden or disability(288).

3.4.7 Impacts of Treatment Burden

The impacts of treatment burden in Parkinson's can be described in the following subthemes: 1) loss of independence for PwP and caregivers, 2) role and social activity limitation and 3) physical and mental exhaustion of self-care. As well as being closely interlinked, both the workload and challenges of treatment burden described in the previous sections can impact the lives of PwP and their caregivers.

3.4.7.1 Loss of independence for PwP and caregivers

As PD gradually progressed leading to physical and mental deterioration in some PwP, they described the unavoidable loss of personal independence and subsequently having to rely on others(295). PwP reported being increasingly reliant on other people for help as PD progressed(262, 284, 295). PwP described frustration due to their increasing dependence on others to help manage their medications or attend healthcare appointments and becoming a burden on their caregivers(295).

> *"I cannot even buy my drugs or go to the doctor alone, and one of my family members has to come with me. They're also busy themselves but it cannot be helped. Believe me, I cannot handle all this by myself."[PwP](295)*

Similarly, caregivers described a loss of independence as their lives now revolved around the person with PD and helping to manage the unpredictable symptoms of PD and complex medication schedules which therefore also impact on their social activities(275, 286). Yet, some PwP and caregivers reported that their strong sense of independence may in fact be potentially detrimental as it stopped some of them from asking for help when it was needed(279).

> *"Another participant hinted, how her sense of independence may have been a barrier to asking for home care services: "I never asked." In the end, though she decided to "just give up" asking for physiotherapy services and decided to "get used to it", suggesting that a sense of learned helplessness had finally been adopted by her as a coping strategy." [Author and PwP](279)*

3.4.7.2 Role and social activity limitation

Both PwP and caregivers described how their lives had changed and were instead spent completing the tasks required for their health with PD, such as taking medication, managing their symptoms and medication efficacy that may be difficult to predict on a day-to-day basis(259-261, 265, 269). Family members or friends of the person with PD found themselves taking on the role of a caregiver(133, 262). Furthermore, as PD progressed, caregivers reported providing increasing assistance to the person with PD with personal care, medications, mobility and transport(133).

> *"Yeah, if she takes the medicine at 8:00, then we can schedule a doctor's appointment for 9:00, because the tremors will be over, and we can be dressed. If we can get back by 11:00, then we can take medicine at home." [Caregiver](259)*

Their ability to plan or attend social activities outside of home relied on taking multiple medications at different times of the day with variable effectiveness as well the medication side-effects(261, 265, 275).

> *"It is awkward. And you cannot plan that in 1½ hours you will be doing this and this, because if the medication doesn't work, whether it is too little or too much, then you are not well. Everything falls apart. You get an invitation – yes, I might come…right?" [PwP](261)*

In patients who had DBS, some reported that they no longer had to plan their activities based on PD medication timings and enjoyed the freedom that DBS provided them in their lives(260).

However, other patients with DBS described how malfunction of the device could disrupt their usual routine or prevent participation in new activities(260).

> *"This made them able to live more spontaneously, not left to plan things 'in between' medication times as had been the case before DBS." [Author](260)*

3.4.7.3 Physical and Mental Exhaustion of Self-care

PwP and caregivers reported that their day was dictated by medication timings, attending appointments or therapy, and ensuring appropriate dietary intake and exercise(133, 260, 262, 285). These activities were a constant reminder of their life with PD and increasing recognition that they may not go back to living a normal life(260).

> *"PD was always in their mind. Participant 4 said: ''I must say, I am sick of talking about Parkinson's."" [Author and PwP](260)*

Caregivers of PwP found themselves taking responsibility for the health of the person with PD, particularly as symptoms progressed and the capacity for self-care decreased(133, 262). Yet, the due to the lack of information and access to available support services left them feeling physically and mentally exhausted(262, 280, 282). They reported that making decisions about the care of the person with PD given the lack of information and uncertainty about what to expect with PD was very stressful(271, 280).

> *"When you have no experience, when you are going through it for the first time and you are trying to find your feet, I found that very stressful." [Caregiver](280)*

Caregivers also reported how the task of helping to manage PD on top of the other LTCs for the person with PD may be overwhelming and consequently lead to the person with PD moving into placement to help manage their care(259).

3.5 Discussion

To the best of my knowledge, this is the first systematic review to explore the experiences of treatment burden in PwP and caregivers. None of the included articles in this review aimed to explore the notion of treatment burden in PwP and/or their caregivers. Using Eton's framework of treatment burden for data synthesis, the main issues of treatment burden in PwP and caregivers relate to: 1) managing the medication workload despite the challenges, 2) learning about health

and issues getting the right information, and 3) healthcare obstacles at individual and system-level due to difficulties attending healthcare appointments, poor interactions with healthcare professionals, and challenges with the healthcare system. There were also issues of treatment burden that specifically relate to PD such as the fluctuation of PD medication efficacy, the impact symptoms and progression of PD, inadequate information regarding the prognosis of PD, lack of service provision for patients with severe PD, challenges experienced by PwP and caregivers in hospital or care home settings, and issues related to DBS.

3.5.1 Main Components of Treatment Burden in Parkinson's Disease

Eton's framework was useful in identifying the issues of treatment burden in PD. However, it was challenging to separate the three main themes (workload, challenges, and impact) as described in Eton's framework as the main issues that impact treatment burden in PD appear to be closely interlinked (see Figure 16, page 141). In fact, two studies using the Patient Experience with Treatment and Self-management (PETS) treatment burden measure that was developed based on Eton's framework reported that the various constructs of treatment burden were closely correlated with one another(87, 118). These studies included patients with multimorbidity (other than PD) living in the USA.

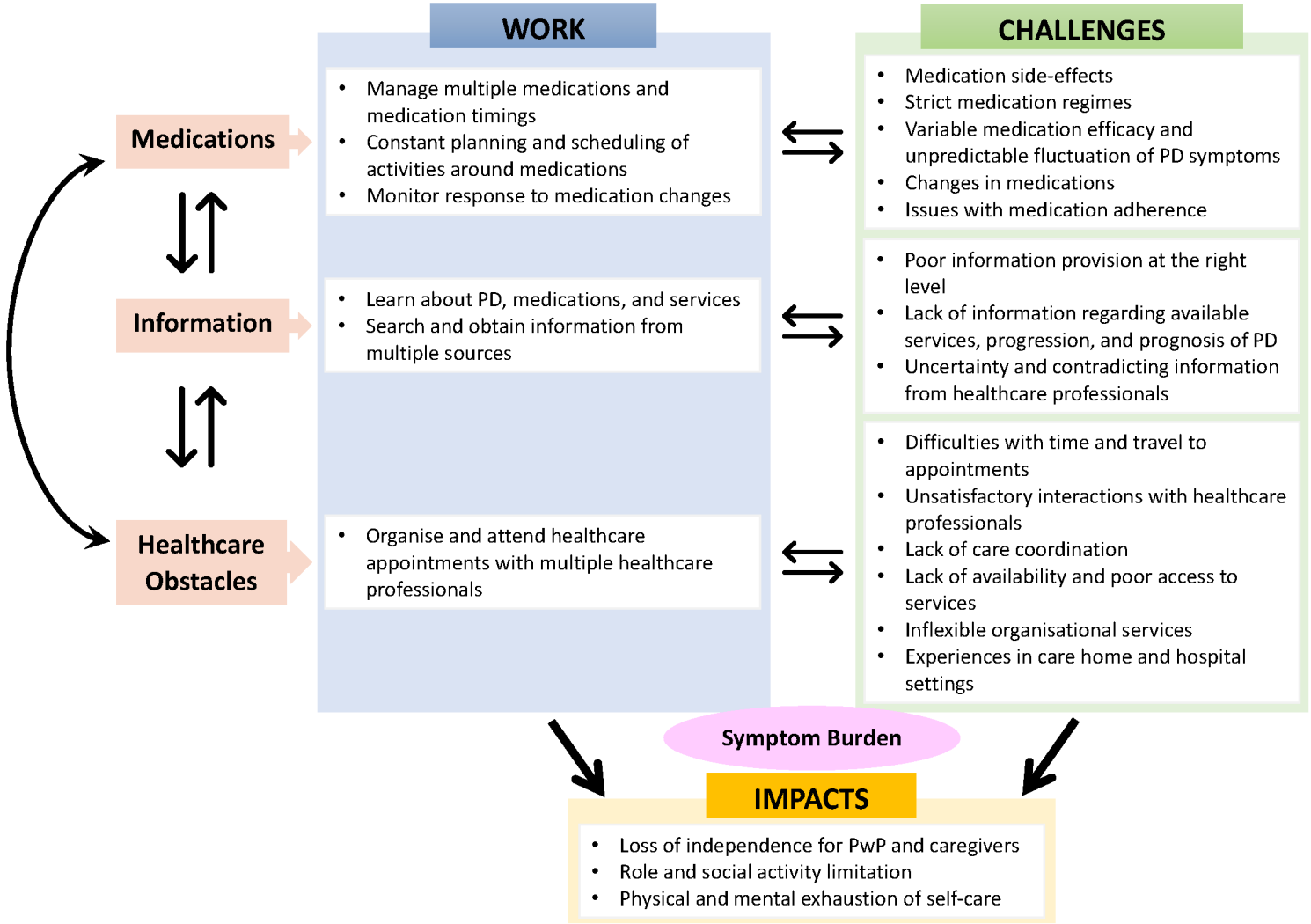


Figure 16: Main components of treatment burden in Parkinson's disease

Firstly, the treatment burden experienced by PwP and caregivers due to the **work and challenges of medications** were closely interlinked (see Figure 17). For instance, PwP may need to take more medications to manage the side-effects related to PD medications which added to their medication workload. Likewise, the frequent changes in PD medication doses and timings due to the variable medication efficacy and fluctuating symptoms meant that PwP and caregivers planned and scheduled their activities around their medication regimes. Consequently, the increasing medication workload led to some PwP and caregivers seeking information to increase their knowledge on how to manage multiple medications. This also illustrates the interlinked issues between different aspects of treatment burden in PD as the medication workload can also increase the workload related to obtaining information.

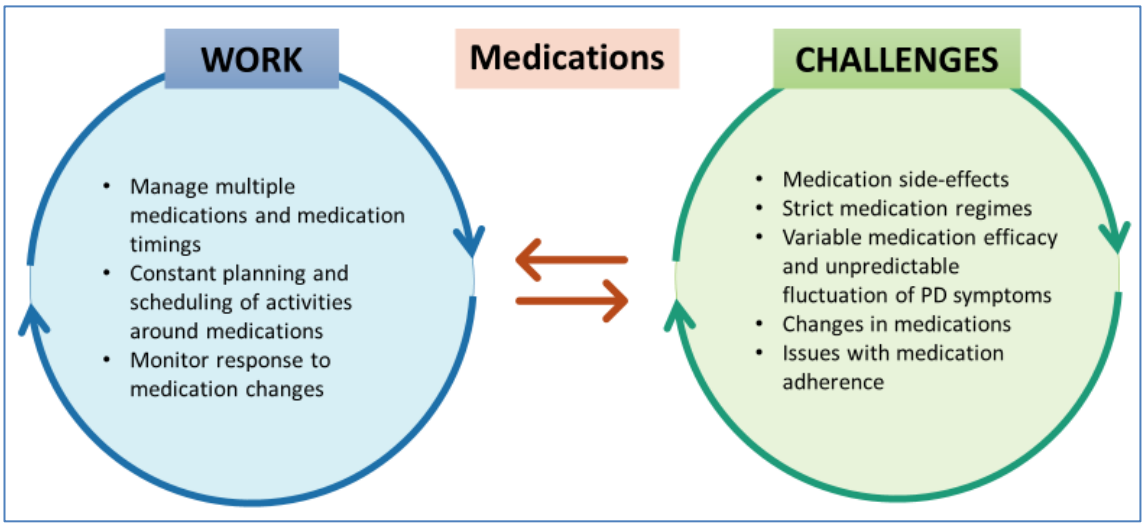


Figure 17: Treatment burden related to medications

Secondly, the **work and challenges associated with obtaining information and learning about health with PD** was a main issue of treatment burden reported by PwP and caregivers (see Figure 18, page 143). They described the workload related to learning about PD, PD medications, side-effects, and how to access healthcare services whilst living with PD. However, PwP and caregivers reported a lack of information provision and difficulty obtaining appropriate levels of information that were relevant to their health circumstances. Due to this, they were at times uncertain about how to manage situations such as unexpected medication side-effects or emergencies such as falls. Some also reported receiving conflicting information from healthcare professionals which caused confusion. This meant that PwP and caregivers searched for information themselves from various sources such as support groups or the internet which added to their treatment burden.

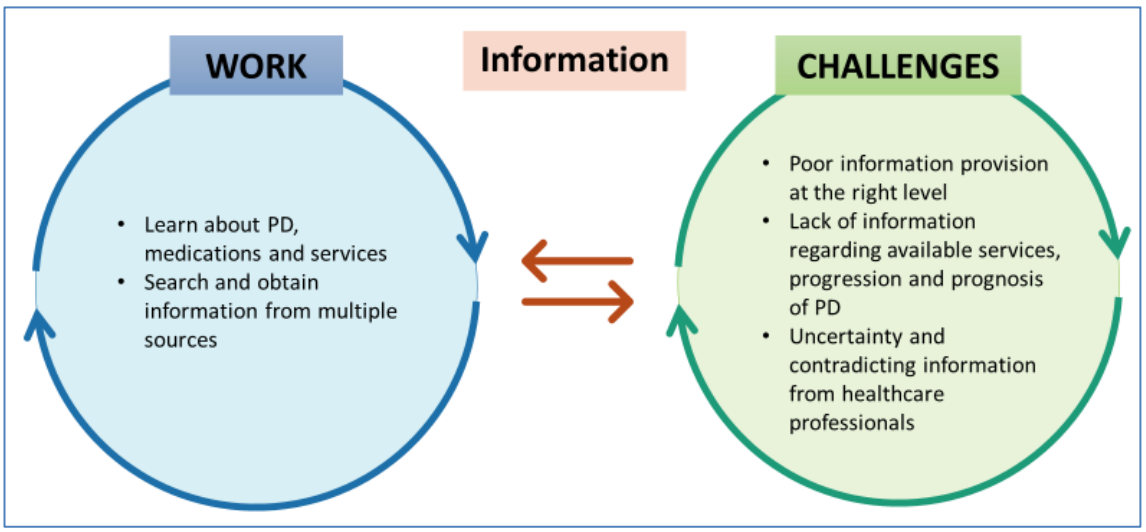


Figure 18: Treatment burden related to information

Finally, PwP and caregivers described how the **work of organising and attending healthcare appointments** was exacerbated by their experiences due to healthcare obstacles at both an individual and system-level (see Figure 19, page 144). Getting to appointments can be challenging due to difficulties with transport and long travel times. Healthcare obstacles at individual provider level include unsatisfactory interactions with healthcare professionals and a lack of holistic care at their appointments. PwP and caregivers reported poor experiences at healthcare appointments due to the predominant focus on symptoms or medications by healthcare professionals rather than the psychosocial factors that may be more concerning for them. At a healthcare system-level, PwP and caregivers reported how the lack of care coordination between services and lack of access to services contributed to their treatment burden. For example, the lack of cohesion meant that PwP and their caregivers experienced conflicting information about their health which meant that they had to seek out information themselves, similarly adding to the treatment burden. Issues in care home and hospital settings such as the lack of staff knowledge about PD and the fixed organisation schedules also challenged the accuracy of medication timings for PwP.

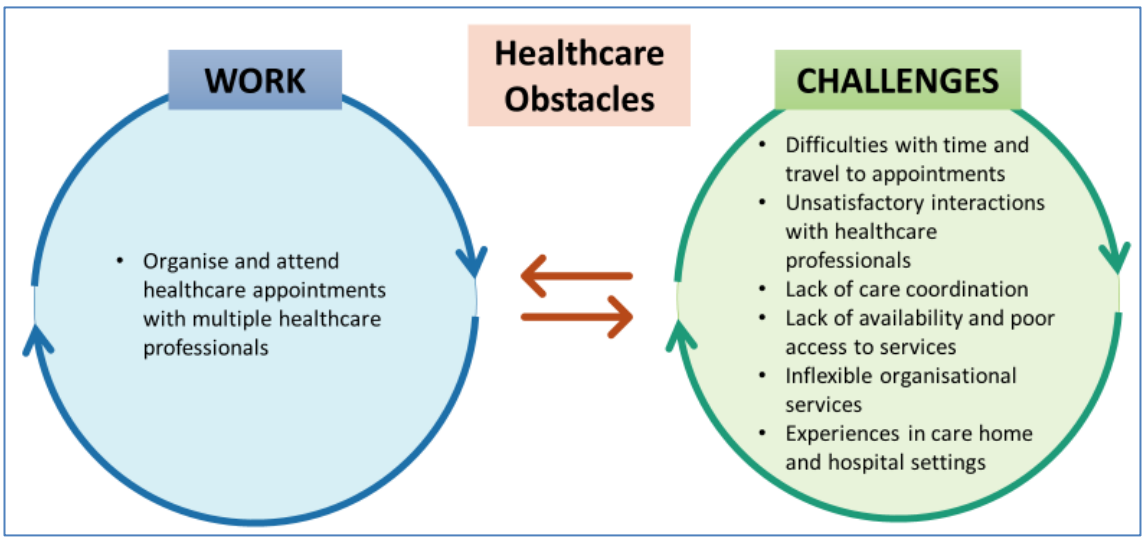


Figure 19: Treatment burden related to healthcare obstacles

These examples described how the workload and challenges of the main issues of treatment burden in PD (**medications, information, healthcare obstacles**) are closely interlinked, rather than separate or distinct issues. Furthermore, as seen in Figure 16 (page 141) both the workload and challenges of treatment burden in PD can also independently impact the lives of PwP and their caregivers. PwP reported a loss of independence and having to rely on their caregivers to help them manage the treatment burden related to medications or attending healthcare appointments, particularly as their PD progressed. As PD progresses, the increasing reliance on caregivers may also impact the independence and lives of caregivers. PwP and caregivers described limitations in their role and social activity their ability to attend social activities were disrupted due to the strict medication timings and need to attend multiple regular healthcare appointments. They reported feeling physically and mentally exhausted as they managed the symptoms of PD, medications, healthcare appointments, dietary requirements, and need for exercise to look after their health with PD.

3.5.2 How does this relate to the current literature?

Managing the medication workload despite the challenges in PD appears to be the dominant issue of treatment burden for both PwP and caregivers. PwP and caregivers spent considerable time and effort planning and organising multiple medications at different times of the day, as well as managing the side-effects of medications. This is intensified by the variability of medication efficacy and inevitable progression of PD with increasing unpredictability and fluctuation of symptoms. This is perhaps not surprising as symptom control in PD is predominantly achieved through pharmacological management. Medications for PD appear to have both a positive and

negative effect on the ability of PwP and caregivers to maintain their independence and social activities. Adhering to PD medications was important to ensure adequate symptom control which enables them to manage the workload of healthcare such as attending healthcare appointments and maintaining lifestyle changes of diet and exercise on top of everyday life. However, the complex medication regimes in PD exacerbated the treatment burden and may subsequently affect medication adherence. Medication aspects of treatment burden have been described in patients with a chronic illness, multimorbidity and heart failure(96, 98, 101, 296). Complex medication regimes, managing and coordinating multiple medications and medication side-effects, associated stigma related to medications and interference of medications on daily activities were reported as factors that increased the treatment burden in these studies. In studies involving patients with heart failure, the constant alterations in medication doses may exacerbate their treatment burden(101, 296). This resonates with the experiences of PwP and caregivers with regard to PD medications.

Issues with obtaining appropriate levels of information regarding PD and available services appear to impact the treatment burden in PD, even though PwP and caregivers had various sources of information available to them. The lack of information provision is also reported in studies of treatment burden in patients with heart failure, stroke, and chronic kidney disease(101, 159, 297). Patients with chronic kidney disease reported that obtaining information on the disease and treatment was significantly burdensome and was exacerbated by short appointment times, medical jargon and high levels of anxiety(297). Patients with heart failure and chronic kidney disease also reported treatment burden related to the lack of prognostic information and unpredictable future faced with their illnesses(108, 158, 298). This was also reported as the treatment burden experienced by PwP and caregivers.

Studies of treatment burden in other LTCs including stroke, heart failure, COPD and lung cancer, and those with at least one LTC reported that deficiencies of healthcare providers at both individual and system levels are also important factors that increase the treatment burden(77, 98, 103, 159, 296). In patients with stroke, treatment burden due to healthcare provider issues at a system level resulting from the lack of communication between primary care and pharmacy services led to confusion about medication prescriptions(77). At a health provider individual level, patients with stroke reported that poor doctor-patient communication meant that they were at times not informed about changes in medications(77). This relates to the findings from this review that describes how the issues of treatment burden in PD are closely interlinked. Other healthcare provider issues such as poor communication, lack of trust and lack of continuity between patients and healthcare professionals have also been reported as important aspects of treatment burden in patients with multimorbidity(72, 98).

As shown in Figure 16 (page 141), our findings suggest that symptom burden in PD may impact the treatment burden in PwP and caregivers. Whilst we were careful to exclude data related to symptom burden during data extraction, living with PD means that PwP and caregivers must manage numerous symptoms. Managing the fluctuating and progressive symptoms of PD involved multiple medications, frequent changes in medication regimes, obtaining information on managing symptoms and interacting with healthcare professionals. Although symptom burden is a separate notion from treatment burden, changes in disease control, disease severity and presence of other LTCs are associated with treatment burden and capacity(76, 95). In studies involving older adults with multimorbidity and people living with HIV, higher levels of symptom severity are associated with higher levels of treatment burden(109, 110). In particular, high levels of fatigue were reported to be a risk factor for high treatment burden levels(109, 110). However, further research is required to explore the impact of symptom burden on the treatment burden experiences in PD. Although this review did not specifically explore the capacity of PwP and caregivers, the symptoms experienced in PD can also affect their physical and mental ability, which may also impact their capacity to manage the treatment burden. For example, PwP and caregivers report that they were unable to attend healthcare appointments as their PD progressed due to their worsening mobility and lack of suitable transportation. Aspects of capacity in PD will be explored in subsequent Work Packages of this study.

Furthermore, although data related to caregiver burden was not extracted, the findings also suggest that treatment burden in PD may be associated with caregiver burden. Caregivers of PwP reported how helping the person with PD with their medications, healthcare appointments, lifestyle changes, seeking information about PD and learning how to successfully navigate the healthcare system all had an impact on their lives and daily activities. This treatment burden experienced by caregivers led to changes in their role, a loss of independence, and feeling isolated due to the lack of adequate support. Attempting to complete the treatment burden was physically and mentally exhausting for caregivers. This aligned with findings reported by Sav et al that caregivers of people with a LTC may experience treatment burden which can lead to distress and frustration in caregivers as well as cause caregivers to neglect their own life and needs, including their health and well-being(122). However, further research is needed to explore the relationship between the treatment burden experienced by caregivers and caregiver burden in PD.

A previous study developing and validating the MTBQ as a measure for treatment burden showed that high treatment burden is associated with a higher number of LTCs, depression and dementia(80). These factors are common in PwP and may also attribute to high treatment burden in PD, although more research is required. A large cohort study in Scotland reported that 31% of

PwP have more than five co-morbidities (physical and mental conditions) compared to 13% in patients without PD(41). However, aspects of treatment burden associated with LTCs other than PD were mentioned less frequently than we anticipated in our review. This may be because PwP and their caregivers must manage the symptoms and complications of PD daily and therefore experience treatment burden predominantly related to PD compared to other LTCs.

3.5.3 Strengths and Limitations

A strength of this qualitative systematic review is that 32 of the 39 included studies involved caregivers of PwP. This is a strength as a recent systematic review by Sheehan et al reported only six studies exploring caregiver treatment burden and highlighted the lack of research in caregiver treatment burden(84). These studies involved caregivers of older adults with and without multimorbidity, caregivers of patients with lung cancer and COPD, and caregivers of patients with at least one LTC such as cancer, diabetes, or cardiovascular disease(98, 103, 122, 124, 299). Moreover, the use of broad search terms in this systematic review unlike those used in Sheehan et al's systematic review led to the inclusion of multiple studies that also described aspects of treatment burden experienced by caregivers. Data synthesis was conducted using framework synthesis guided by Eton's framework of treatment burden, which is a novel method of data synthesis(41).

This review has several limitations. Firstly, none of the studies explored treatment burden as the primary aim. Data extraction was therefore not straightforward as the primary aim of each study did not relate to treatment burden experiences. There was considerable data on the experiences of PD that relate to the illness, including experiences of diagnosis and impact on the lives of PwP and caregivers. Although we found various aspects of treatment burden from the included articles, data extraction was not conducted from the original interview transcripts of studies and may be interpreted out of context. Whilst we were careful to include all aspects of treatment burden during data extraction, prior knowledge of Eton's framework may have influenced data extraction. Multiple discussions were held between myself and my supervisor (KI, who was also the second reviewer for data extraction) to ensure that all relevant data related to the workload of healthcare in PD were included. This process also increased rigour. Secondly, the inclusion criteria limited the inclusion of papers published from year 2006 onwards to identify the current experiences of PwP and caregivers following the introduction of the NICE UK PD guidelines. However, this may be different to PD guidelines in the other countries included in this review. Nevertheless, exploration of the current experiences of service users will help inform the development and changes to health services and/or policy(103, 159). The exclusion of grey

literature may also be a limitation as it may have resulted in the exclusion of potentially relevant data without publication bias in this review(300). Due to the lack of translation services, non-English articles were excluded during the full-text screening stage of this review. This may be another limitation. However, to capture a range of treatment burden experiences across different countries and healthcare systems, no geographical exclusions were applied.

3.6 Conclusion

This qualitative systematic review has explored the experiences of treatment burden among PwP and their caregiver, which has identified the main issues of treatment burden. PwP and caregivers with high medication burden, those with insufficient information provision, and those who navigate through multiple healthcare services may experience high treatment burden. There are potential strategies that may reduce the treatment burden experiences in PD. Future research that focuses on treatment burden as the main outcome for PwP and caregivers to identify the potentially modifiable factors that can improve the treatment burden is required.

3.7 Implications and Next Steps

There is a need for healthcare professionals to identify PwP and caregivers who may experience high treatment burden as they are potentially at risk of treatment non-adherence and subsequent poor health outcomes. Establishing patients' and caregivers' priorities with good communication and a move towards patient-centred care with a holistic approach by healthcare professionals can play a role in improving the treatment burden in PD(73, 93). Therefore, the subsequent Work Packages of this study will aim to understand the modifiable factors at both individual and system levels that can reduce the treatment burden or enhance the capacity of PwP and caregivers. This may improve adherence to treatment and health outcomes for PwP. The published paper from this systematic review is shown in Appendix H (page 331).

Chapter 4 Work Package 2 – Semi-Structured Interviews

4.1 Introduction to Chapter

This chapter built on Work Package 1 (systematic review) and will describe Work Package 2 of the PD Life Study which involved qualitative interviews with PwP and their caregivers. The methodological considerations for conducting qualitative interviews were previously described in Section 2.7.1 (page 85).

4.1.1 Rationale

The systematic review highlighted the main issues of treatment burden in PwP and caregivers that relate to: 1) managing the medication workload despite the challenges, 2) learning about health and issues getting the right information, and 3) healthcare obstacles at individual and system levels. No previous primary qualitative studies have specifically explored the treatment burden and capacity in PD. Therefore, conducting interviews with PwP and caregivers enabled us to gain an in-depth understanding and exploration of their perspectives and experiences of treatment burden and capacity when managing their health with PD, building on findings from the systematic review.

4.1.2 Aim

Semi-structured interviews were conducted to explore the modifiable factors that impact treatment burden and capacity of PwP and their caregivers.

4.2 Methods

4.2.1 Participant Recruitment and Sampling

Potential participants were recruited from two PD outpatient clinics in Hampshire and Dorset. Recruitment from two NHS hospitals with different local healthcare policies within the Wessex region would enable the inclusion of participants with varying experiences with access and interactions with healthcare professionals when managing their PD. Participants were approached by me after their PD clinic appointment following consent from their PD specialist. Participants were provided with a brief explanation of the study and a study pack containing a participant information sheet. They were given at least 24 hours to consider their participation in the study. Interested participants returned a reply slip with their contact details and were then contacted by me to arrange an interview at their convenience. Inclusion criteria were adult participants (age >18 years old) who had a diagnosis of PD or was a caregiver for someone with PD and were able to consent to participate. Participants were excluded if they lacked the capacity to consent.

Purposive sampling was conducted based on age, sex, PD severity (Hoehn & Yahr staging) and caregiver relationship (spouse/partner/family member/friend) to achieve a participant sample that was inclusive of the diverse population of PwP and caregivers. This was based on the heterogeneity of PD and from the hypothesis based on clinical experience that PwP and caregivers may have different experiences of treatment burden and capacity when managing their health with PD at different stages of PD. As the interviews progressed, it was decided that the inclusion of patients with PD dementia and caregiver of someone with PD dementia would be beneficial even though it was not included in the initial sampling. This was decided as most PwP develop cognitive impairment and dementia as PD progresses in the later years and may therefore have different perspectives and experiences.

4.2.1 Development of interview guide

Two interview guides were developed: one for the person with PD (see Appendix I, page 353) and one for the caregiver of someone with PD (see Appendix J, page 357), with close parallels between both interview guides. They were initially developed using Eton's framework of treatment burden and a literature review of published interview schedules from other qualitative studies of treatment burden and capacity conducted with patients with chronic kidney disease, stroke, and patients on haemodialysis treatment(74, 77, 108, 301). Findings from the systematic

review also influenced the questions in the interview guides. The interview guides were adapted following multiple iterations with my supervisors and reviewed by our PPI group to ensure flexibility of the topics discussed and applicability to the personal and clinical experience in PD. The semi-structured interviews allowed the inclusion of open-ended questions to ensure that all aspects of treatment burden and capacity based on participants' experiences were addressed in the interviews, and not just those included in Eton's framework or from the systematic review findings.

The interview guides were then piloted with two patients with PD and one caregiver of someone with PD in February 2021. Due to the COVID-19 pandemic, virtual interviews online were conducted instead of face-to-face and lasted approximately 30-40 minutes. All three participants reported that the questions were relevant, easy to understand, and did not cause distress. The pilot interviews highlighted potential issues when arranging virtual interviews online due to a lack of audio at the start which required troubleshooting from a relative who helped resolve the matter and emphasised the importance of organising interviews based on participants' preferences and convenience due to the nature of PD medication timings for PwP. The final interview guides provided me with a helpful reminder of the important questions during the interview and included prompts to guide the conversation towards issues related to treatment burden and capacity.

4.2.2 Data Collection

Seventeen one-to-one interviews were conducted, with 16 interviews conducted face-to-face, and one interview virtually between June to November 2021. Fifteen of the face-to-face interviews were conducted at the participant's home and one interview was conducted in a private meeting room at the local hospital. It was difficult to interview the PwP and caregiver separately on two occasions. On the first occasion, the caregiver (wife of a person with PD) declined to participate in the study but then at times listened in to different parts of the interview and added her views. Her views were not analysed from the interview transcripts. During the interviews, I tried to clarify any comments and experiences from his wife with the person with PD to see if he had similar or contrasting views from his wife. On the second occasion, although both the person with PD and caregiver agreed to separate interviews, it proved problematic to find another room during the interviews. To try and mitigate this, I reiterated at the start of the interview that each of them would be asked a separate set of questions individually and that they would each be able to express their own views and experiences in turn. I also made sure to direct the question to each participant and tried to bring the focus back to their individual experiences.

Although the presence of their spouse during the interview may have influenced their responses due to the lack of privacy, I felt that all participants were able to answer questions openly and honestly despite this.

Interviews lasted between 45 to 75 minutes. Following the interviews, I took notes of the specific context and personal circumstances of each participant that may be relevant to their experiences of treatment burden and capacity in PD. Initial issues related to treatment burden and capacity were noted down. All interviews were audio-recorded following written consent and transcribed verbatim by a research assistant in the Academic Geriatric Medicine department. Interview recordings were deleted following transcription. Interview transcripts were fully anonymised with all participants' identifiable data removed before data analysis.

4.2.3 Data analysis

Data analysis was conducted using thematic analysis assisted by Nvivo Pro 12(198). The steps involved in thematic analysis were described in detail in Section 2.7.3 (page 89). I read the interview transcripts multiple times to familiarise myself with the data. This was read alongside post-interview notes and the context including length of diagnosis, PD severity, and living situation. An inductive approach and line-by-line coding of each transcript were conducted. There were 267 codes generated following the coding of the first six interview transcripts. These initial codes were then merged to represent the overlapping main issues of treatment burden and/or capacity. Codes were then collated into potential themes relating to treatment burden, with interlinked issues of capacity. Each theme was then reviewed according to the coded extracts (Level 1) and the entire data set (Level 2) to check whether they represented the data collected and to look for links between and within the subthemes and themes generated. This was an iterative process. Multiple mind maps were created to identify any links and relationships between the subthemes and themes.

4.2.4 Reflexivity

The advantages and disadvantages of being a clinician conducting qualitative research were previously discussed in Section 2.10 (page 103). Participants were recruited from PD clinics where I was introduced as a specialist registrar in geriatric medicine and PhD student conducting a research study. The participant information sheet also informed participants of my roles as a doctor and researcher. Knowledge of my role as a clinician may have influenced the participants' responses during the interview. However, at the start of each interview, I made sure to introduce

myself with my first name and reiterated that I was there as a researcher to explore their views and experiences of managing their health with PD. I also reminded participants at the start of the interview that any information and shared experiences that they divulge to me will be kept confidential and will not be shared with anyone else including their clinical team without their explicit consent.

Furthermore, I found that it was important to reiterate at the beginning of the interview that the aim was to explore the work and tasks that they had to do for their health and provided specific examples such as taking medications, attending appointments, getting information, dietary changes or doing exercise. This may have predisposed participants' responses to questions related to treatment burden experiences. However, this was necessary as PwP and caregivers often spoke about the symptoms, progression and impact of PD during the interviews. This made it challenging at times to explore the specific aspects and impact of treatment burden and capacity. Instead, it was useful asking them to describe their experiences of living with PD, and then progress the conversation with specific questions about the work they had to do to manage their health with PD and explore this further. The semi-structured approach to interviews allowed for this flexibility rather than being pre-defined by the order of questions in the interview guide.

Having conducted framework synthesis guided by Eton's framework of treatment burden in Work Package 1, I needed to keep an open mind during data analysis and coding of the interview transcripts to ensure that I was not limited by Eton's framework. Although I tried to maintain an inductive approach during coding, findings from the systematic review may have also influenced data analysis. To reduce this bias, I made sure to immerse myself in the data by reading the interview transcripts multiple times alongside my interview notes to interpret the data within the specific context and situation of each participant. Several meetings were held between myself and my supervisors to ensure that data were coded openly and not organised based on Eton's framework and that data interpretation reflected participants' experiences.

4.3 Results

4.3.1 Participants

A total of 17 participants (see Table 16, page 154) were recruited including nine participants with PD (5 males; 4 females) and eight caregivers (1 male, 7 females). Participants ages ranged from 59 to 84 years old (mean age=73 years), length of PD diagnosis ranged from one to 17 years, and

H&Y stages ranged from 1-4. All participants were living at home, 14 with a spouse and three on their own. Two participants with PD did not have a caregiver. Four patient-caregiver couples participated in the interviews, including one couple with DBS treatment and one with PD dementia. Other caregiver relationships with the person with PD included a sister and a daughter.

Table 16: Interview participants' characteristics

Study ID	Sex	Age (years)	Length of PD diagnosis (years)	H&Y stage	Living situation	Caregiver relationship
P01	F	78	13	2	Alone	No caregiver
P02	M	84	3	3	With spouse	Wife
P03	M	78	1	3	With spouse	Wife
P04	F	79	10	4	With spouse	Husband
P05*	M	72	17	4	With spouse	Wife
P06	M	71	4	1	With spouse	Wife
P07	F	82	5	3	Alone	Daughter
P08	F	72	11	3	With spouse	No caregiver
P09†	M	72	4	3	With spouse	Wife
C01	F	78	1	3	With spouse	Wife
C02	F	73	9	3	With spouse	Sister
C03	M	70	10	4	With spouse	Husband
C04	F	70	13	3	With spouse	Wife
C05**	F	71	17	4	With spouse	Wife
C06	F	67	4	1	With spouse	Wife
C07	F	59	5	3	Alone	Daughter
C08†	F	73	4	3	With spouse	Wife

*C, Caregiver of someone with PD; F, Female; M, Male; P; Patient with PD *Deep brain stimulation treatment; **Caregiver of someone with deep brain stimulation treatment; †Diagnosed with PD dementia, ††Caregiver of someone with PD dementia*

4.3.2 Treatment Burden and Capacity in PD

The experiences of treatment burden and capacity reported by PwP and caregivers can be summarised in the following four themes (see Table 17, page 156): 1) Attending multiple appointments and accessing healthcare professionals, 2) Getting satisfactory levels of information related to PD, 3) Managing prescriptions and medication issues, 4) Personal life adaptation. There are interlinks between the themes and within each theme as described in the next subsections. Moreover, there were aspects of capacity that specifically relate to each theme as seen in Table 17. Each theme and subtheme with supportive quotes are described in the next subsections.

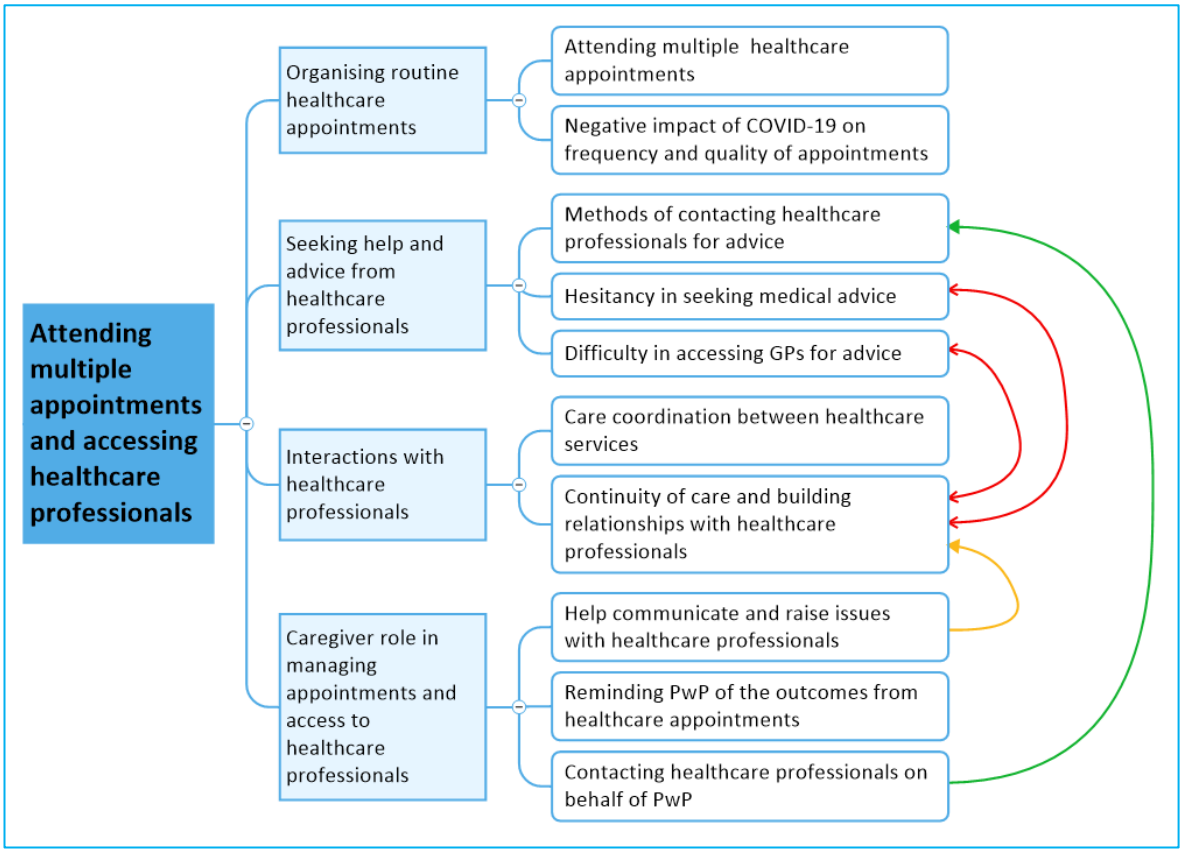
Table 17: Themes of Treatment burden and Aspects of Capacity in Parkinson's Disease

Themes	Subthemes	Codes	Aspects of Capacity
Theme 1: Healthcare appointments and access to healthcare professionals	Organising routine healthcare appointments	• Attending multiple healthcare appointments • Negative impact of COVID-19 on quality and frequency of appointments	○ Driving ability and access to car of PwP or caregiver and Blue Badge for parking ○ Housing proximity to hospital and access to public transport ○ Access to computer to contact healthcare professionals ○ Having a caregiver increases capacity of PwP to manage healthcare appointments
	Seeking help and advice from healthcare professionals	• Methods of contacting healthcare professionals • Hesitancy in seeking medical advice • Difficulty in accessing GPs for advice	
	Interactions with healthcare professionals	• Care coordination between healthcare services • Continuity of care and building relationships with healthcare professionals	
	Caregiver role during appointments and access to healthcare professionals	• Help communicate and raise issues with healthcare professionals • Reminding PwP of the outcomes from healthcare appointments • Contacting healthcare professionals on behalf of PwP	
Theme 2:	Information provision from multiple sources	• Receiving and signposting to information • Searching for information • Learning from personal and other people's experiences	○ Family members to help provide and explain information

Getting satisfactory levels of information related to PD	Understanding information and satisfaction with levels of information provided	• Understanding information provided • Poor levels of information provided • Personal preference for information related to PD	○ Access to computer to search for information ○ Personal life experiences and health literacy
Theme 3: **Managing prescriptions and medication issues**	Getting prescriptions right	• Errors in prescriptions • Collecting prescriptions	○ Access to computer to order prescriptions ○ Housing proximity to pharmacy ○ Prescription delivery services ○ Routinisation and use of pill devices and reminders ○ Positive symptom control with medications ○ Having a caregiver increases capacity of PwP to manage prescriptions and polypharmacy
	Managing polypharmacy and its impact on PwP and caregivers	• Taking multiple medications at different times • Monitoring response to treatment and impact of missed medications • Approaches to help medication taking	
	Autonomy to adjust treatments	• Seeking advice from healthcare professionals • Taking control of PD treatments	
Theme 4: Personal life adaptation	Exercising and keeping physically active	• Attending physiotherapy and exercise classes • Maintaining physical activity	○ Physical ability ○ Financial capacity
	Changes in dietary intake	• Maintaining healthy diet • Changes in diet due to PD medications and symptoms	
	Financial costs of managing health	• Expenses related to travel to appointments, equipment, mobility aids, lifestyle changes, and practical support for daily activities	

4.3.2.1 Theme 1 - Healthcare appointments and access to healthcare professionals

This theme describes the aspects of treatment burden and capacity reported by PwP and caregivers when attending multiple healthcare appointments and issues with access to healthcare professionals. The interlinks between the subthemes are shown in Figure 20.



**Coloured arrows depict interlinks between subthemes*

Figure 20: Theme 1 - Healthcare appointments and access to healthcare professionals

4.3.2.1.1 Organising routine healthcare appointments

This subtheme describes the treatment burden related to attending multiple appointments, dissatisfaction with the frequency of appointments, changes in appointments, arranging appointments and the negative impact of the COVID-19 pandemic on appointments. The ability to drive and access a car, Blue Badge for parking, and housing proximity to the hospital were aspects of capacity that support this treatment burden.

Attending multiple healthcare appointments

PwP and caregivers described attending **appointments with various healthcare professionals** including the PD specialist, PD nurse specialist, GP, physiotherapist, occupational therapist, older people's mental health team, psychologist, and speech and language therapist. There was a range of satisfaction levels regarding the **frequency of healthcare appointments** with the PD team (PD specialist and nurse specialist). Most participants reported regular six-monthly or yearly appointments with the PD team and accepted this as part of their management with PD. However, a few participants living with PD for less than five years reported that they would like more frequent appointments with the PD specialist, such as every three months instead.

> *"I think probably, instead of seeing a Consultant once every six months I think, perhaps three would be better." P06*

A few PwP and caregivers described the unexpected **changes in planned appointments** with healthcare professionals and the negative impact on patients.

> *"You know, (husband) doesn't want to be seeing the Doctor on the 7th June, and then find out he not seeing him till the 2nd of August and then it gets changed again which frequently happens. And I just feel that perhaps they should think a little bit more as that sort of thing can jolt people. It can get them quite stressed out." C06*

The system for **arranging appointments** was also reported to be challenging to negotiate. One PwP and their caregiver described having to contact a central appointments team that was difficult to get hold of and only had a limited number of appointments, causing frustration and distress.

> *"The system in this part of the world is you have to go out to the appointments team. And they have a list of so many people, they release so many appointments a month, and you've got to keep ringing and ringing and ringing." P06*

The **ability to drive and access a car** meant that PwP and caregivers were able to attend their healthcare appointments. Where the person with PD was unable to drive or had given up driving due to PD, their caregiver was able to take them to their appointments. Issues with parking at hospitals for appointments were also reported by PwP and caregivers. One participant with PD requested to be seen at a different hospital where he knew that parking access and distance from the car park to the hospital were more accessible for him given his poor mobility with PD. He reported that having **access to a Blue Badge** helped with this.

"To get to hospitals I drive, (wife) doesn't. If I'm ill, we can't get there." P06

"Parking's a bit of a problem sometimes. I've got a Blue Badge and everything, which helps." P05

Few participants reported that the **proximity of the hospital from their home** and convenient access to public transport meant that getting to the appointments was within walking distance or a short car or bus journey. In comparison, one participant with PD and his caregiver reported travelling long distances over the last seven years and navigating parking issues at a specialist hospital in a different region to attend multiple appointments to manage his deep brain stimulation (DBS).

"It means basically that I'll have to get up at 5, to get out at 6 if they give us a 9.30 appointment. Cos parking at the (hospital) is an absolute nightmare. And Neurology has its own car park. So, to get there, and to get parked, you need to get there very early in the morning." C05

Negative impact of COVID-19 on frequency and quality of appointments

Some PwP and caregivers described the negative impact of the COVID-19 pandemic on their healthcare appointments. Firstly, they reported **cancelled or delayed appointments** with concerns about the potential loss of follow-up. A few participants chose to cancel their appointments as they did not want to attend the hospital due to worries about COVID-19.

"Well, it all stopped (appointments with the DBS team) due to COVID and I haven't heard from them for about a year. I don't know what's happening. I will have to e-mail them." P05

Secondly, there was a change from **face-to-face appointments to telephone appointments**. Nearly all participants reported that they did not like the telephone appointments as they felt that their review of PD symptoms and medications should be assessed in person. Some PwP and caregivers felt that it was difficult to describe their PD symptoms and concerns over the telephone. Other participants with PD reported that their voices are not heard clearly over the telephone due to the impact of PD on their speech and that they felt unable to build any rapport with healthcare professionals over the telephone.

"It's very difficult to have a telephone consultation when the consultant can't see the patient because, you know, you're describing it, but my mum couldn't describe her symptoms so well." C07

4.3.2.1.2 Seeking help and advice from healthcare professionals

This subtheme describes the treatment burden related to contacting healthcare professionals, hesitancy in seeking medical advice, and difficulty getting help and advice from GPs. Access to technology, the ability to use a computer, and having a caregiver were aspects of capacity that support this treatment burden.

Methods of contacting healthcare professionals

PwP and caregivers reported that knowing how to **access the PD team** meant that it was easier for them to get help if required. Most participants reported that their first port of call was the PD nurse specialist, by leaving a **message on the telephone or using the computer**. However, one caregiver stated that they were left waiting to hear back from the PD nurse specialist and that it would be useful to know whether their message had been received and be given an estimated time of when to expect contact in return.

"I think at one time (husband) tried to contact the nurse, and it took a few days for her to come back. And that, you know, he just had to get on with it." C04

Some participants reported difficulty with using a computer to contact healthcare professionals due to their PD symptoms. For example, one participant with PD described the **challenge of using the online GP electronic consultation** due to her PD symptoms of slowness and tremors. Yet, she persisted with it as she reported that it was even more difficult to contact her GP using the telephone.

"And, because I'm very slow and I keep on hitting the wrong button because I'm shaking, so, it's a nuisance to use it. It would be much easier for me if I could just send an e-mail saying, 'this is what I want to see the doctor about'". P08

Hesitancy in seeking medical advice

A few PwP and caregivers reported that they **chose to wait until their planned routine appointments** with the PD team to discuss their concerns, rather than seek help if they had a concern between appointments. For example, one participant with PD reported that he chose not

to seek help from healthcare professionals as he did not want to bother them with any further health issues and did not want to undergo further tests. Others chose to search for information on how to manage any concerns themselves, which links to the treatment burden described in Theme 2. Another participant with PD reported that although her daughter encouraged her to seek help regarding her PD symptoms, she chose not to as she felt that her symptoms would settle on their own without medical input.

> *"Most of it I leave, and I think it will be alright tomorrow sort of thing. But then, if it's quite a while (daughter) says, 'You've gotta do such and such a thing'. She might say, 'Get in touch with the doctor or the nurse or something. Find out what is happening.'" P07*

One participant living with PD for 11 years and reported good control of her PD symptoms had never met a PD nurse specialist since her diagnosis. She felt that she did not need to add another appointment on top of her medical appointments for other LTCs due to the **impact on her personal and social activities**.

> *"Well, I don't think I need to (see PD nurse specialist). As far as I'm concerned, it's just one more bloody visit to medics of some sort. You know, by the time you've gone to the dentist, opticians, consultants for my eyes, and I've got to go and see the doctor about this, it's probably skin cancer. It's nearly always something on that means I have to go out and spend time doing stuff when I might just like to finish reading my book from the library." P08*

Difficulties in accessing GPs for advice

Some PwP and caregivers reported **difficulties trying to access their GP** for advice or appointments and would only contact their GP if they felt that their symptoms were deteriorating rapidly. One participant diagnosed with PD for less than a year reported that he did not discuss his concerns about the lack of response to PD medications with his GP as he thought that his **GP was too busy**. Another participant reported that her GP instead advised her to contact the PD nurse specialist as they had more knowledge about PD.

> *"Because A: you can't get through to them (GP), they just cut you off and B: it's such a rigmarole to get anywhere with anything down there. We don't even bother; we just do not bother. If we've got an issue, we either see, (PD nurse specialist) or we wait until we used to see (PD specialist)." C05*

One caregiver described that the **healthcare pressures and ten-minute appointment slots** available with the GP were insufficient to address the complex health needs of someone with PD.

> *"GPs are so pushed at the moment, they're expected to know a plethora of information about all these conditions and how they even got time. What is it? A ten-minute slot." C07*

However, one participant who has been diagnosed with PD for 13 years reported that she was happy to wait for an available appointment with her GP and felt that there was no urgency for her to be reviewed given the chronicity of her diagnosis.

> *"...but I think I've had this for 13 years another fortnight won't make any difference. Other people I know have been so moody about 'oh, I couldn't see him for another week'. I think, well do you need to see him for another week?" P01*

4.3.2.1.3 Interactions with healthcare professionals

The treatment burden between PwP and their caregivers due to challenges with healthcare systems at both individual provider and system levels include the lack of care coordination between healthcare services, lack of continuity of care, poor communication, and lack of relationship building with healthcare professionals are described in this subtheme.

<u>Care coordination between healthcare services</u>

There were a few participants who had negative experiences with their care coordination between healthcare services. For example, one participant with PD who had DBS and his caregiver reported **poor care coordination between the local PD team and DBS team** who were based in a different region. They described the PD nurse specialist writing to DBS team regarding the potential use of Botox to treat his drooping eyelids, yet had not heard anything back after nine months which may have caused a delay in him receiving treatment locally.

> *"And (PD nurse specialist) is trying to get him Botox, because of the drooping of his eyelids, she wants him to have Botox to try and see if that will help. But she wrote to the (DBS team) in October, asking them if they thought it might help and she's had no reply." C05*

A few participants described their experiences with **poor care coordination between the GP and PD team** after relocating homes leading to delays in getting a follow-up appointment with the PD

specialist. One caregiver reported **poor care coordination between the GP and hospital** when her mother attended the Emergency Department following a fall.

> *"Well, the GP and the hospital from my point of view, they don't appear to talk to each other. And when you go to see the Doctor and say, 'mums had a fall', it seems to be a surprise when you talk to them." C07*

Continuity of care and building relationships with healthcare professionals

PwP and caregivers who reported positive experiences with their PD team described that they were able to build trust and relationships with them, and reported that their concerns were listened to and addressed appropriately. The relationships with healthcare professionals appeared to impact whether PwP and caregivers chose to seek help or advice when required.

> *"(PD nurse specialist) was very popular; she listened, and she didn't rush you. So, if you had an appointment towards lunchtime you knew she was going to be running late. It didn't matter to people." P01*

A few participants with PD reported the impact of changing personnel resulting in the **lack of care continuity with their PD nurse specialist**. They were unable to build rapport and a relationship with their PD nurse specialist, with one PwP choosing instead to see her GP with whom she had a good relationship.

> *"She was approachable if you needed anything, she could point you in the right direction, but she didn't really delve deeply into each individual when you went to see her." P06*

One participant with PD described her poor experiences with her previous PD specialist at the beginning of her diagnosis due to the **lack of shared decision-making** regarding PD medications. She felt that her opinions and reasons for not wanting to start any PD medications were ignored during her appointment. She also reported that her more recent appointments with her current PD specialist mainly focused on trying to resolve any of her issues by using medications rather than trying other non-pharmacological methods.

> *"I get my appointment with the Consultant, and mostly the conversation is around medication. I think that there's too much concentration on resolving the issues by medication rather than by any other method." P08*

Multiple PwP and caregivers reported a **lack of care continuity with their GP** and being unable to see their named GP regarding their overall health. A few PwP and caregivers also reported **poor**

relationships with their GP due to **poor communication, a lack of empathy, and a lack of understanding** about their health concerns with PD. A few participants felt that their concerns were dismissed by the GP, who did not take the time to explore their previous medical history or personal situation with PD. One participant with PD and his caregiver both reported that they preferred that the GP did not interfere with his PD management.

> *"And I just happened to mention to him (husband) had had a low mood, and he turned, and he said to me. 'well (husband) will have to find something that gives him pleasure and get on and do it.'" C05*

> *"But then, I don't want them (GP) interfering. I'm caught. In some respects, I'm quite happy really with how they are, and not interfering." P05*

4.3.2.1.4 Caregiver role during appointments and helping with access to healthcare

Most caregivers reported attending the appointments together with the person with PD and described being grateful when the PD specialist listened to their concerns and answered their questions. Caregivers described helping the person with PD communicate with healthcare professionals due to speech difficulties with PD, prompting the person with PD to discuss issues such as symptoms and medication side-effects, or raising additional issues themselves during appointments with the PD specialist.

> *"Now he's difficult to understand and even I can't hear him sometimes." C02*

One caregiver also described attending physiotherapy appointments as her mother could be forgetful at times and found that this meant she was able to remind her mother of the exercises that were taught and ensure she used the correct technique when using her mobility aids to prevent potential injury.

> *"Because it turned out that mum was using her wheeler all wrong, and things like that. And it would have done damage to her back long term, cos she tries to pick it up off the ground. So, I sat in on her sessions because mum, unfortunately, is forgetting things now, so I can remind her, yes." C07*

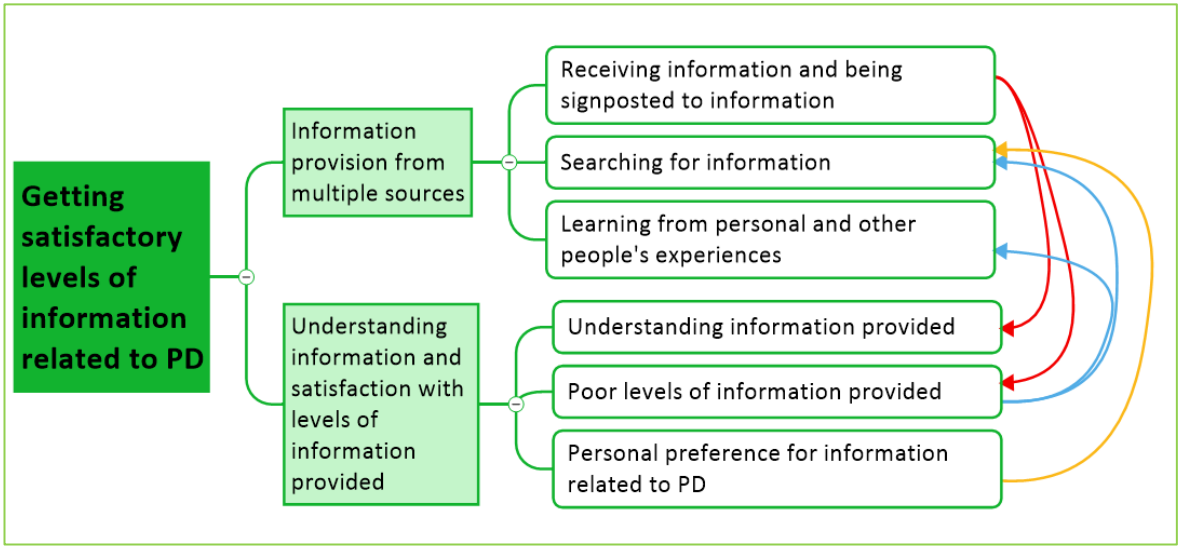
For a few PwP, caregivers described contacting healthcare professionals such as doctors, nurses, frailty teams, pharmacists, and the city council on behalf of the person with PD. This was reported more frequently by caregivers of PwP with mid to later stages of PD. For example, one caregiver

of the person with mid-stage PD (H&Y stage 3) described discussing medication issues with doctors and liaising with the city council to ensure that a care plan was in place.

> *"Thinking about setting in a care plan and having to deal with doctors, that was the first thing, dealing with the doctors and the medication. And then, the council; the frailty team; the nurses that were dealing with him." C02*

4.3.2.2 Theme 2 - Getting satisfactory levels of information related to PD

This theme describes the aspects of treatment burden and capacity reported by PwP and caregivers with getting satisfactory levels of information related to PD. The subthemes within this theme are: 1) Information provision from multiple sources, and 2) Understanding information and satisfaction with levels of information provided. These subthemes are closely interlinked as seen in Figure 21 (page 166).



**Coloured arrows depict interlinks between subthemes*

Figure 21: Theme 2 - Getting satisfactory levels of information related to Parkinson's disease

4.3.2.2.1 Information provision from multiple sources

This subtheme describes the issues experienced by PwP and caregivers when receiving information from multiple sources and being signposted to information, searching for information themselves, and learning from their own and others' experiences. Aspects of capacity that

support this treatment burden include having family members to help provide information and the ability to access a computer.

Receiving information and being signposted to information

Following PD diagnosis, PwP and caregivers reported that they received **information about PD from multiple sources** including healthcare professionals, Parkinson's UK, and family members. They were given information about the diagnosis of PD, PD medications, and the practical aspects of living with PD such as the impact on driving and insurance from their PD specialist doctor and PD nurse specialist.

> *"You learn so much. Things, things I never knew existed about PD so that, to me was the biggest help. That group I think should be all over the country for everybody." C06*

One participant with PD described that as well as getting information from his PD specialist, **his son looked up information** about PD after his diagnosis and sent it to him to read.

> *"(PD specialist) explained, and my son that died did quite an analysis on it and fed a lot of information. So that's how it was developed and, cos I hadn't a clue what it was." P02*

PwP and caregivers also spoke about how they were **signposted to Parkinson's UK and local support groups** by the PD nurse specialist. Joining Parkinson's UK enabled PwP and caregivers to receive regular information regarding PD through leaflets, booklets, magazines, and the website. Unfortunately, due to the COVID-19 pandemic, a few participants reported that support group meetings were cancelled, or they chose not to attend.

> *"The first meeting we went to there was the Parkinson's UK representative and she was wonderful. She sat down and she was talking to everyone. This leaflet, that leaflet; she was helping a lady trying to get a bed for her husband and I thought this was just incredible." C06*

Searching for information

The ability to **access technology and use a computer** meant that PwP and caregivers were able to go online and used websites such as Google, Parkinson's UK or Medline Plus to **search for information regarding PD**. PwP and caregivers wanted to learn more information themselves on how to manage the symptoms of PD, medication side-effects, or devices that can help with

medication adherence. Having more detailed information about PD helped PwP and caregivers ease their worries and manage their health with PD.

> *"So, you know, if you were worried about a certain thing, you'd just get the book out and find a page that had some, and it puts your mind at rest I think." C08*

Another participant with DBS searched online for research papers and learnt that the settings of his DBS device to manage his tremors also consequently led to his eyes drooping at times. However, other PwP and caregivers purposely avoided looking for information on the internet as it could be confusing and difficult to understand.

> *"And I got about half a dozen research papers upstairs that I've picked around the bits I understand and it's come up with the sort of things that they found do interfere with stimulation and the things that are beneficial." P05*

<u>Learning from personal and other people's experiences</u>

The variability of symptoms and progression of disease amongst people with PD meant it was not always possible to know what to expect despite the information provided. Consequently, PwP and caregivers described how they learnt how to manage their PD from their **own day-to-day experiences**.

> *"And the other stuff is just learning on the hoof because we asked (PD specialist) what to expect and the bottom line is that no one person is the same with PD so he couldn't tell us exactly what to expect." C03*

One participant with PD described how she learnt about the potential health issues that may occur as PD progresses from her own experiences of caring for her partner with PD such as issues with swallowing, discussions about resuscitation and end of life care.

> *"He didn't want any artificial tubes or anything, you know, or resuscitation and all that. Now that's where I got some information from, cos I was his carer or partner or whatever you wanted to call me. He said 'No, you must come with me I don't want to do it on my own'." P01*

Participants found that talking to other PwP and caregivers helped them **learn from other people's experiences** on how to manage their PD. A few caregivers learnt about other important aspects of caregiving from their friends or family members who had experience caring for someone with a LTC. Attending Parkinson's UK local support groups with other PwP and

caregivers enabled them to feel supported. However, for a few participants, seeing other PwP reminded them of the future deterioration and what could potentially happen to them with PD.

> *"He was given some PD medication and it didn't agree with him but because he was told to take it for 6 months, he took it for 6 months and it did something to his mind. And he never recovered from it." P05*

4.3.2.2.2 Understanding information and satisfaction with levels of information provided

This subtheme describes the issues reported by PwP and caregivers with understanding the information provided, poor levels of information provision, and their personal preferences about the levels of information received regarding PD. Personal life circumstances and experiences, having family members, and health literacy were aspects of capacity linked to this subtheme.

Understanding information provided

Most PwP and caregivers reported that they were able to understand the information provided to them regarding PD, although some described it as a learning process. It was evident that the **personal life circumstances and experiences** of PwP and caregivers influenced their ability to understand the information provided. For example, one participant with PD reported that he found it easy to understand information related to medications due to his previous occupation working with a pharmaceutical company. Another participant with PD reported that the medical terms were difficult to understand at times. Both these participants had continued further education after secondary school, and yet may each have different health literacy levels based on their personal experiences.

> *"So, I'm used to it and it's crazy because, all the work that I was doing 30-40 years ago, the same people are coming up with the same information today." P03*

Some PwP and caregivers described how they were able to **seek help from their family members** to understand information related to PD. One participant with PD was able to ask her daughter for help if there were sections in the Parkinson's UK magazine that she did not fully understand.

> *"Well, I sort of read the headlines in the difficult bit, and if there was anything that alarmed me, I asked my daughter to see if she knew any better cos she did a doctorate in Biology." P01*

PwP and caregivers reported that understanding the information provided and being prepared for what to expect meant that they were able to recognise that their symptoms were related to PD. Receiving **clear explanations of the medical issues from healthcare professionals** helped them understand, accept, and manage their health with PD.

> *"And it was, (PD Nurse) that once told me that if that happens, cos I mean I've had funny 5 minutes, I think most women do. It's an imbalance; lots of chemicals and looking at it now, she was right wasn't she cos they were imbalanced. I think they're balanced now, cos you know I'm okay." P01*

Conversely, there were PwP and caregivers who felt they did not understand what the diagnosis of PD meant, what the aetiology of PD was, or what their potential prognosis was with PD as they were not given clear explanations from healthcare professionals. This meant that there were times that they felt 'left alone', with no support. This highlights the importance of good communication from healthcare professionals in helping PwP and caregivers understand information related to PD, which also interlinks with issues described in Theme 1.

> *"What do I know about the aetiology of Parkinson's? Is there any sensible information which says it is caused by, it could be as a result of? … But there's all this talk that Dopamine all the time, and I don't really understand it." P03*

Poor levels of information provided

Some PwP and caregivers described **poor information provision** following the initial diagnosis of PD, particularly about their long-term future and prognosis with PD. Furthermore, caregivers also described a lack of information about what symptoms of PD can occur, any potential worst-case scenarios, and how to care for someone with PD. One participant living with PD for ten years and her caregiver both described how the lack of information regarding the consequences of constipation in PD led to her being admitted to the hospital in an emergency, which could have been avoided. Her caregiver also reported the lack of information provided about ways to manage the daily tasks of supporting his wife and learning from his own caring experiences.

> *"If I'd known about that, I'd probably have saved myself a trip to hospital. And same with constipation I ended up in hospital cos I got a small blockage. And if I'd known about that, I would have not ended up in hospital." P04*

> *"It would be nice for someone to actually, I've never read it anywhere that it's likely that the principal carer, will have a huge amount of just mopping up to do. I wish they'd said*

that you know. It would be so helpful. At least you'd know that goes with the territory." C03

Due to the lack of information provided, PwP and caregivers reported searching for information themselves or relying on their families to provide them with information. A few caregivers also described that out of desperation and uncertainty about PD, they searched for information by going to the library or using the internet even though they did not particularly want to.

"… but I don't do the internet. I don't really like it very much and (husband) when he does do it, it's a lot of is rubbish, you know, well we all know that." C06

Personal preference for information related to PD

It was clear that each participant had a personal preference about the levels of information related to PD that they wanted to know. Some participants reported that they wanted to **know as much information** as they could, whilst others preferred **not to know more** than what was required.

"So, the information is out there, it's whether you want it or not. I know several people who don't want to know, whereas I did want to know, and I still want to know." P01

One participant diagnosed with PD for 17 years described that he followed advice from his PD specialist to learn as much as he could about PD to help him make informed choices about his treatment and medication options when living with PD. Due to this, he preferred to search for more information and felt that this has helped him manage his PD ever since his diagnosis.

"Consultant said to me, 'if you want my advice, learn as much as you can about Parkinson's. Read everything you can; try and find the association and, learn everything you can so you can make informed choices about your treatment and medication and things like that.' So, I followed his advice." P05

On the other hand, other PwP and caregivers chose not to know more information to avoid worrying about the future. Some PwP and caregivers felt that they were provided with the **right level of information** regarding PD. One caregiver whose wife has been diagnosed with PD for ten years felt that he knew enough information and was grateful that the PD specialist did not overload him with too much information about PD as this could potentially be distressing.

> *"But there again, if they load too much of what might happen, they might break you when you're first diagnosed, you know. (PD specialist) is very clever in the way that he doesn't open the floodgates of the poison that is PD, you know." C03*

Furthermore, PwP and caregivers may **change their preferences** regarding the levels of information they wanted their PD progresses. For instance, one participant with PD described how she searched for as much information regarding PD using the internet and Parkinson's UK after her initial diagnosis. However, after living with PD for 11 years, she reported that she has enough information to manage her PD and now prefers not to search for information and carry on with her daily life where possible.

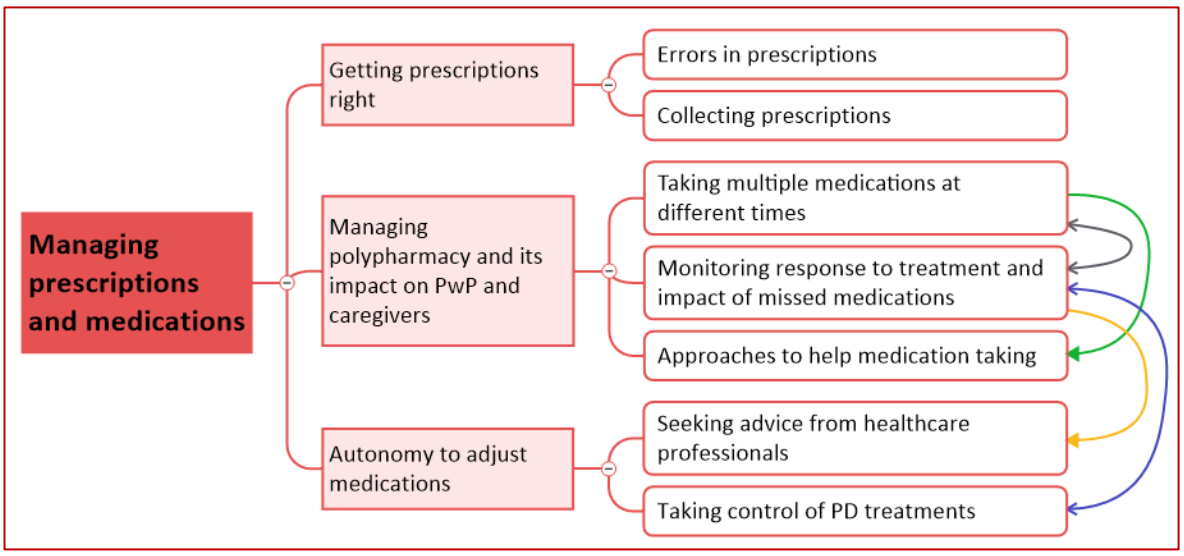
> *"I have a fair idea about what might happen to me Parkinson's wise so I can generally tell whether something is or isn't. And if I'm not sure, I don't really bother to know, I get on with my life." P08*

At times, there also appeared to be **conflicting opinions between the person with PD and their caregiver** about their personal preferences of information levels. For example, one caregiver reported that she tried to encourage her brother with PD to read and learn more about his condition and how to manage this as she found the information provided to be very helpful. However, she wasn't sure if he also wanted to know more information about how to manage his health.

> *"I said to him a couple of times, '(name) you must read this it's really helpful'. I said, 'Not just on the physio and movements on it, there are other things', but I don't how much he does once I go out the door." C02*

4.3.2.3 Theme 3 - Managing prescriptions and medication issues

The aspects of treatment burden and capacity related to prescriptions and medications are described below with close interlinks between subthemes (see Figure 22, page 173).



**Coloured arrows depict interlinks between subthemes*

Figure 22: Theme 3 - Managing prescriptions and medication issues

4.3.2.3.1 Getting prescriptions right

This subtheme describes the treatment burden due to medication prescription errors and issues collecting prescriptions. Aspects of capacity that support this include ordering repeat prescriptions online, close vicinity of pharmacy to home, help from a caregiver to collect prescriptions for PwP, and availability of prescription delivery services.

Errors in prescriptions

Some PwP and caregivers reported times when there were **errors in prescriptions due to miscommunication** between the PD specialist, GP, and pharmacy. For example, one caregiver reported how she had to liaise between the PD specialist and GP to rectify a prescription error on behalf of the person with PD due to a lack of communication. She also described **delays in obtaining changes in prescriptions** despite the use of electronic prescriptions between the GP and pharmacy. The treatment burden when managing errors in prescriptions is also interlinked with issues of poor communication and lack of care coordination between healthcare services as described in Theme 1.

> *"(PD specialist), previously had changed the dose, and he forgot to tell the GP Surgery. No, he told the GP Surgery, he forgot to tell mum that the dose had changed. I went to*

collect her prescription; I looked at it and said, 'no hang on, you've got the dosage wrong'". C07

"I've probably taken 20 minutes running between the pharmacy and the GP, where the GP said something, well via the receptionist, cos you can never see the GP. And then you go back to the pharmacy, and they say 'right medication, right prescription should have come through now', cos they've sent the wrong prescription for whatever reason. And you get to the pharmacy and they say, 'it's not come through, it must be in the ether somewhere'." C07

The caregiver also checked the prescriptions and noted that there were also times when **not all the medications had arrived**. She described her gratitude that she had noted this on behalf of her mother with PD for whom she had some concerns regarding her worsening memory.

"Where something's been missing; it's on the prescription but it's not arrived. Or something's missing off there. Saying she put a repeat prescription in for X, Y, Z, and we've only got X. Where's Y and Z gone you know? So they're the silly little things that I've experienced and thank goodness I'm there." C07

One participant with PD and his caregiver reported their anger and frustration when his PD medication prescription was changed by his GP to generic medication rather than branded medication without consulting them or his medical records. They were not informed of this change despite previously trialling the generic medication replacement which had caused multiple side-effects and negatively affected his PD symptom control. This incident had a negative impact on their relationship with their GP resulting in them choosing not to contact their GP unless it was the last resort, which also interlinks with hesitancy in seeking medical advice described previously in Theme 1.

"Well, when I'd had Parkinson's for about six years, I was put on the generic replacement for Ropinirole cos it was cheaper. And it didn't agree with me. My Parkinson's became very unstable and had a lot of side effects. And I, I argued with my GP, it's the generic Ropinirole that's doing it and they said it's the same." P05

Collecting prescriptions

Some PwP reported that they were able to **use their computers to order their prescriptions online** and get to the pharmacy on their own to collect their prescriptions. However, other PwP **relied on their caregivers** to complete this task. A few participants also commented that the **close**

vicinity of the pharmacy to their home and GP surgery made it easier to collect their prescriptions. One participant with PD described that the **difficulty of parking her car** at the pharmacy due to her PD meant that her husband collected it on her behalf instead. **Delays in getting prescriptions** ready by pharmacists were perceived as troublesome for the person with PD with mobility issues who were reliant on their medications.

> *"And when she goes to the pharmacy, and they say, 'oh, go away', well they don't say 'go away'. 'We haven't got it, come back later'. 'Come back this afternoon'. And you know she can't actually get back, but she needs this stuff, you know." C07*

Participants reported the benefits of **prescription delivery services** that emerged during the COVID-19 pandemic. However, one caregiver described how angry and unhappy he felt when his pharmacy reduced the number of patients who were offered this service. He felt that the further additional task of collecting prescriptions would have amplified his caregiving role for his wife with PD.

> *"And then they wanted to cut down on the deliveries, and so they culled me. And I went round to the Pharmacy and said 'look, ah, I understand you've culled me off the list. I don't know if you realise but I was up to my ears in it at the time, probably with both my health and (wife's) health and at the end of my tether." C03*

4.3.2.3.2 Managing polypharmacy and its impact on PwP and caregivers

The issues described in this subtheme relate to taking multiple medications at different times including interactions with medications for other health conditions, monitoring response to PD treatment including the impact of missed medications on PD symptoms, medication side-effects, and DBS treatment. PwP and caregivers also described the different approaches that help them with the medication burden, which were aspects of capacity.

<u>Taking multiple medications at different times</u>

PwP and caregivers reported taking **multiple medications**, ranging from one to 19 medications at **different times a day** to manage their PD and other LTCs such as hypertension, diabetes, hypercholesterolaemia, and asthma. A few participants with PD also described the impact of **medications for other LTCs** on their PD symptoms such as feeling dizzy due to low blood pressure exacerbated by their blood pressure medications.

> *"Do I carry on taking the Amlodipine blood pressure tablet, knowing that it stops my blood pressure from going a bit too high in the evenings? But also knowing that it's likely to make me feel sick after breakfast and possibly pass out." P08*

Due to this polypharmacy, PwP and caregivers stated being vigilant when reading medication names and instructions on the prescriptions to avoid confusion or errors. One participant with PD reported that it took at least 30 minutes to organise her medications daily and was constantly double-checking herself due to concerns that she may take the wrong medications as the pills look the same despite the different dosages.

> *"I'm managing fine except it takes me at least half-an-hour in the morning to put them together and that, cos I have them, I think it's about 19 tablets. And it's then that I think, get the tablets container. It says to take one three times a day say, so I get three out, put them in some things where they've gotta go, read it up make sure it's the right one, and I'm over checking myself all the time." P07*

Monitoring response to treatment and impact of missed medications

Although a few participants reported that taking multiple medications may be tiresome at times, the noticeable **positive response of PD symptoms** when taking their PD medications meant that some PwP and caregivers felt that PD medications were a necessity and made sure not to miss any doses. PwP and caregivers also recognised that the **effects of PD medications can vary** from day to day particularly as PD progresses.

> *"It varies, sometimes she'll have more dyskinesia. But other days she'll be almost normal. She'll be really good which is not as often as we like but, you know, when they come, they're a great surprise and joy, when you've got a normal day." C03*

Some participants also described the **PD medication side-effects** that they experienced such as feeling spaced out, hallucinations, depression, irritability, agitation, and anxiety. The side-effects settled with time in some PwP, but also resulted in medication changes for others. The participant and caregiver with DBS also reported **side-effects of DBS** treatment affecting his speech and eyelid closure.

> *"I tried Sinemet and that killed me, I came to a grinding halt. I was quite ill on that, so I went to Madopar and that was better. It did control my tremor a little bit, but I got really depressed on it, so I stopped taking that." P05*

Other PwP reported that despite persisting with their PD medications as instructed, there was a **lack of improvement in their PD symptoms**. On the other hand, their caregivers did notice an improvement in their symptoms. For example, one participant with PD who had been diagnosed with PD for one year reported that the lack of improvement in his symptoms after starting medications made him question the accuracy of his diagnosis. However, his caregiver described that she noticed an initial improvement in his PD symptoms after starting medications, but was starting to wonder if the dose or frequency of his PD medications needed to be increased.

> *"I mean I continue to be clumsy, sadly. I always take (wife) a mug of tea and I have great difficulty, you notice our stairs are very steep anyway, and I'm very unsteady… I'm not convinced that the drugs or regime I am on is doing anything." P03*

Most PwP and caregivers reported that their PD medications had to be taken at specific times of the day and were aware of the changes in PD symptoms when they were **late in taking their medications or missed doses** of their PD medications. For instance, one caregiver described the deterioration in mobility that occurred when the person with PD had not managed to take her medications on time. Another caregiver reported that the person with PD she cared for experienced a fall and admission to the hospital after missing his PD medications. This strict medication timing can **stop PwP and caregivers from doing their usual activities.**

> *"Suddenly she gets up from the chair and finds she can't actually walk to the door cos everything's stopped. You know, and that's just the effect of, so yes it does make a difference. Yes, we have been late, but that's when she's really late taking, you know." C07*

> *"Yes, and we have to have things at certain times, medication. The alarm will go off at three o'clock. Yes, it stops you from doing things." P04*

Having **other LTCs** such as hypertension meant that a few PwP and caregivers reported monitoring their blood pressure at home and response to anti-hypertensive medications to avoid issues with low blood pressure commonly associated with PD. However, movement issues with PD meant that putting on the blood pressure cuff can be difficult for some PwP. Whilst another participant described how it was difficult to remember to check her blood pressure twice a day as advised by her PD specialist.

> *"If I want to record it, like a morning and evening, which is what (PD Specialist) asked me to for a week once I decided to start taking the tablets again. Then, I just think to myself, 'I've got to remember to do it in the morning and the evening.'" P08*

Approaches to help medication taking

PwP and caregivers described **routinising medication** taking into their daily activities, **writing down their medication schedules** or using multiple different types of **pill devices and technology** including pill boxes, plastic pots, pill dispenser carousel, blister packs, and setting alarms on the iPad® or using Alexa® device to help with medication taking. Nevertheless, there were times when issues with pill devices interfered with their medication timings due to the batteries running out or not knowing how to change the time on the device when the clocks moved forwards.

> *"We've come to a little bit of a glitch when we had the time go back an hour. These little electric things we got, I thought I could put the time back. Both my wife and I tried, we are waiting for my daughter to turn up on Wednesday." P09*

However, PwP and caregivers may have to adapt and learn new ways of managing their medications as their PD progresses. The progressive PD symptoms and issues with swallowing pills meant that one participant with PD and her caregivers living with PD for ten years described recently learning that they can dissolve PD medications in water and use a straw to help swallow medications. This also demonstrates the continuous learning process that PwP and caregivers may experience when living with PD as described in Theme 2.

> *"She has found that, recently, only in the last month or so that if you suck it up with a straw because it settles down because it's dispersible, not soluble, if you take it with a straw, you get the most from that sinks down the bottom anyway." C03*

Where the person with PD was unable to manage their medications on their own due to PD symptoms such as issues with fine movements and memory, their **caregivers may shoulder more responsibility in managing medications**. Caregivers reported helping the person with PD by taking out their medications from the packaging, laying medications during mealtimes or reminding them that their medications were due. A few caregivers also reported taking extra PD medications when they leave the house in case the person with PD forgot to take their medications. One participant with PD dementia reported that he was reliant on his wife to manage his multiple medications. This was echoed by his wife who described how her role in helping her husband with his PD changed as his memory deteriorated and he was unable to manage his medications. She reported not only helping to organise his medications in the pill box but also checking that he had taken the right medications on time as there had been occasions where he had taken the wrong medications despite the use of alarms.

"He will take the wrong tablet at the wrong time, and you say to him, 'you know, what happened there?'. I mean, even now, with his timer box he's got. Sometimes it'll go off and he'll go out to the kitchen, and I think he gets a drink and gets lost and takes a drink and doesn't take tablets. So, I'm always having to look in the little box to check." C08

4.3.2.3.3 Autonomy to adjust treatments

This subtheme describes the treatment burden of adjusting medications, including choosing to seek advice from healthcare professionals or taking control of their own treatments.

Seeking advice from healthcare professionals

PwP and caregivers described the changes in their treatment for PD with adjustments in medication doses and timings to manage their PD with contrasting attitudes to treatment changes reported by participants. Firstly, PwP described that they always **sought advice from their PD specialist or PD nurse specialist** before changing any medications and strictly followed the instructions on the prescriptions regarding medication times and doses.

"That's her instructions yes, prescriptions. It says take this at these times, you know, she needs that. She definitely needs that. If it's written down, she'll follow. She's not very good at deviating." C07

Despite this, PwP and caregivers reported that they were still given the final autonomy of whether to increase or decrease their medication doses after considering the benefits and side-effects. One participant reported that his PD specialist has already written to his GP about the possibility of adding another medication if he felt that his symptoms had deteriorated further before his next appointment.

"I've been offered other medication since, which I declined, but I feel the side-effects would be worse than the sentence if you like. Although a deterioration has happened probably within the last six months, something like that." P06

One participant with DBS reported regular six-weekly appointments with healthcare professionals for nearly one year to achieve optimal control of his PD symptoms with the voltage adjustments of his DBS settings. This may have added to the work of managing appointments as described in Theme 1. Due to his progressive symptoms, he now relies on his wife to help him with charging the DBS device.

"I wanted to try and reduce my eye closure, and I wanted to be able to control the tremor at the same time. And I had a target to get to for the pulse width and a target to get to the frequency, a range of voltages that I wanted to try and get to, see if I could get to it." P05

Taking control of PD treatments

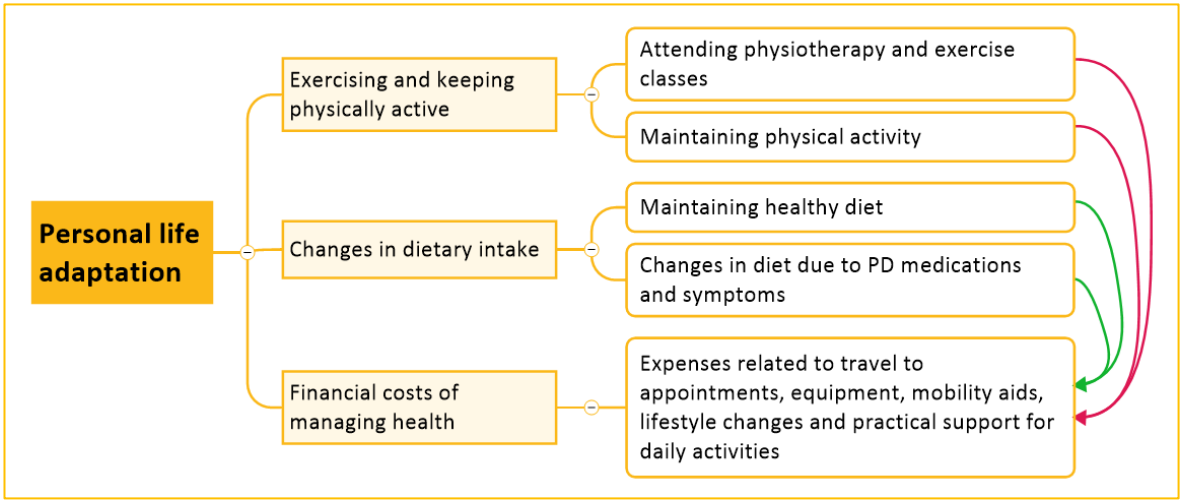
In contrast, other PwP reported that they **took control of their medications** and varied medication timings to suit their planned personal activities despite the instructions on the prescriptions. One participant with PD adapted her medication timings as she felt that she was the best person to understand her health and body's response to medications.

"And if anybody says to me, I'm not doing well, I'm only doing average, and that my prescription for how to deal with my disease isn't best for me then they can go take a jump as far as I'm concerned because it's what I decided about me. So, I'm fiercely in control of what I do for me." P08

Another participant with PD for 17 years who had DBS treatment remained on only a single medication for PD as he described that he preferred to listen to his brain and remain undertreated for his PD despite recommendations from the PD team. He and his wife also **discussed any medication changes** between themselves and weighed up the impact of any medication changes. Consequently, they agreed that they preferred that he remained mentally alert rather than have better mobility with the addition of PD medications.

4.3.2.4 Theme 4 – Personal life adaptation

This theme describes the treatment burden and capacity that occurs due to the personal life adaptation of PwP and their caregivers. The subthemes are closely interlinked as seen in Figure 23, page 181).



**Coloured arrows depict interlinks between subthemes*

Figure 23: Theme 4 - Personal life adaptation

4.3.2.4.1 Exercising and keeping physically active

Some PwP and caregivers reported being referred to the physiotherapist by their PD team and given exercises that helped improve balance, walking, ability to stand up from the chair and the appropriate use of mobility aids. However, other PwP felt that the exercises did not make any difference although they admitted that they had not been completing the exercises at home. A few PwP also reported that they did not complete the given exercises at home due to symptoms of fatigue and weakness associated with PD, and instead chose to prioritise other personal activities when they felt able to.

> *"I did go through all the exercises and that with the nurses up there, and I did them quite well. But now, most of the time I'm too weak to do them. Like if I feel weak and I can't be doing it, when I'm feeling better, I want to catch up on something I can do." P07*

Most PwP and caregivers reported that they tried to keep physically active by taking a walk daily or doing gardening as they felt that this was beneficial in PD. A few caregivers described encouraging the person with PD to keep active and go for a walk with them, even though the PD meant their walk was at a slower pace.

> *"I feel he needs to go out most days just to get a bit of exercise and keep his momentum going." C08*

A few PwP and caregivers also reported paying to attend exercise classes or having a personal trainer at a gym to ensure that they have regular exercise weekly. However, due to the COVID-19 pandemic, some participants reported a noticeable deterioration in the mobility of the person with PD as they were not able to be as physically active.

> *"I go to the gym once a week and see a personal trainer and that helps a lot. Kept me muscles, muscle strength up and kept me mobile." P05*

4.3.2.4.2 Changes in dietary intake

Some PwP and caregivers reported eating a healthy diet by consuming more fresh fruits and vegetables and maintaining a steady weight to manage their health with PD. Others reported stopping alcohol or cheese on their own accord as they found that it interacted with their PD medications and affected their mobility and ability to carry out activities.

> *"I try and be careful what I'm eating. Certain things I try and avoid it if I'm doing anything that requires going out as it interferes with the absorption of Ropinirole. Like cheese, I love cheese, but it blocks the Ropinirole." P05*

Furthermore, swallowing and dexterity issues due to PD meant that PwP and caregivers reported changing to softer meals to help with eating. One caregiver also described cutting up the food into smaller pieces for the person with PD as it made it easier to manage.

> *"At the dinner table, I'll go and cut his food up for him as he is struggling with eating." C02*

4.3.2.4.3 Financial costs of managing health

Some PwP and caregivers described the financial expenditure to help manage their overall health and well-being. One participant with PD and caregiver described paying for a hotel due to the far distance of their hospital appointment for DBS. Furthermore, the impact of PD symptoms meant that PwP and caregivers reported buying equipment and mobility aids such as a shower stool, shower rails, walker, trolley, or wheelchair to help with their mobility and maintain independence. The benefits of the mobility aids meant that they were still able to leave the house for activities and day outs and therefore felt that this far outweighed any financial costs incurred.

"We decided that it was time for me to have a wheelchair just to use if we go out for a day and go to the gardens. I can go out to the gardens in the wheelchair and it'll be more relaxing." P05

Other financial expenditures included the cost of exercise classes or a personal trainer as described in the previous theme. A few participants reported undertaking personal home renovations to make it more accessible for the person with PD. Other participants also described planning potential changes to their homes in preparation for the progression and worsening of mobility with PD. Some PwP and caregivers also reported that due to the symptoms of PD, they were no longer able to complete their activities of daily living and reported paying for private carers, a cleaner, and delivery of meals.

"We've got a bigger shower now. A walk-in shower and all aids for (husband). So, we had to have the fourth bedroom smaller to make a really big bathroom for him." C05

Most participants interviewed reported that they were grateful that they were able to afford the additional expenditure for health due to good pensions and support from their families. One caregiver reported being thankful for receiving attendance allowance from the government to pay towards the cost of carers. A few also reported that they obtained equipment for free from the NHS or after applying to their local council.

"I've been lucky that I've got a good pension so I can afford to have the personal trainer once a week, for an hour. But I accept that a lot of people if you've only got your state pension, you wouldn't be able to afford it."P05

4.3.2.5 Other aspects of patient and caregiver capacity

Furthermore, there were overall aspects of capacity described by PwP and caregivers to help manage the treatment burden in PD (see Figure 24, page 186). These aspects are described further in this section and include: 1) Personal approach and strategies to manage PD, 2) Life responsibilities and 3) Practical and emotional support.

Personal approach and strategies to manage PD diagnosis

PwP and caregivers reported the initial shock they experienced following the diagnosis of PD and recognised that there was no cure for PD. They described that the lack of control over PD meant that acceptance of the diagnosis was important to avoid living a miserable life and feeling frustrated. PwP and caregivers described their approach and strategies that helped them manage

and accept the diagnosis, progressive symptoms, and impact of PD. This included **maintaining a positive attitude, a strong sense of independence, having a sense of humour, being level-headed and taking each day as it comes**. Many participants also highlighted the importance of a strong relationship between the person with PD and caregivers by being honest, having open communication and working together. Over the years, PwP and caregivers accepted the impact of PD on their lives and learned how to manage to live with PD, which interlinks to the findings described in Theme 2.

> *"I suppose I have no alternative. You have to get on with it; you have to try and manage it the best you can. I think fatigue's the hardest thing, because if you're fatigued you can't do anything, or you feel you can't do anything. Sometimes you have to push yourself." P06*

A few PwP and caregivers described comparing their diagnosis to other chronic conditions that they perceived to be more devastating such as dementia or cancer and consequently being grateful for the PD diagnosis. One participant with PD and caregiver described the importance of their **faith and religion** in helping them accept the challenges of living with PD and making the most of their lives.

> *"I think the good thing was I accepted it from the beginning cos I knew there was something wrong and, with the Lord's help I was able to knuckle to and sort myself out and make the most of it." P04*

<u>Practical and emotional support from family members and social networks</u>

All caregivers interviewed were family members of the person with PD and had an important role in helping the person with PD look after their health as described in the four themes above. On top of that, caregivers also reported helping the person with PD with activities of daily living such as washing, dressing, cooking, shopping, managing finances, gardening and many more. One participant with PD who lived alone and did not have family living nearby described a strong sense of self-reliance and surrounded herself with additional practical help.

> *"I have surrounded myself with help so, although once Covid came she stopped doing my hair and I found out how to do it myself. So, I did have a hairdresser; I have a gardener; I have a cleaner; I have a window cleaner." P01*

Both PwP and caregivers also described the invaluable practical, emotional, and psychological **support from their family members and wider social networks** such as friends, neighbours,

church members, and local Parkinson's UK support groups. For example, one caregiver of someone with PD dementia reported that their daughter who lives 50 miles away comes to their house weekly to support them and helps take them to exercise classes and hospital appointments. Discussing and sharing experiences with other people in the same situation meant PwP and caregivers felt supported and were able to learn how best to manage their PD from other people's experiences, as previously described in Theme 2.

> *"We (neighbours) all know each other so if you get into a fix like when (wife) fell in the garden and I had to go and get help to try and get her up, from (name) so, that's, that's where, and our church home group is very good as well." C03*

Few PwP and caregivers reported the importance of where they lived and **proximity to family members, and amenities** such as the post office and grocery shops. One person with PD and their caregiver reported that they chose to relocate to be near to their family members and researched whether their flat would be accessible to the local hospitals by public transport. Caregivers who lived nearby to the person with PD reported that it was easy for them to drive over regularly to provide support.

> *"It's only a couple of miles, it's not far. Oh, well, there's the cycle path. It takes longer by car, but it's a 10-minute drive, so it's okay I can be there very quickly," C07*

Other life responsibilities

A few PwP and caregivers also described juggling the treatment burden described in the previous themes as well as **other life responsibilities and demands** such as work, household maintenance and other caring responsibilities for elderly parents or grandchildren. Some caregivers described their fortunate position of no longer working and therefore having more time to manage caring for someone with PD as well as the treatment burden of PD. One person with PD reported prioritising her caring responsibilities over her PD medications and only taking her medications when she remembered instead.

> *"We have got quite a busy life really. My business takes up quite a lot; grandchildren do; and the work here. It's quite a difficult house to keep going really." C01*

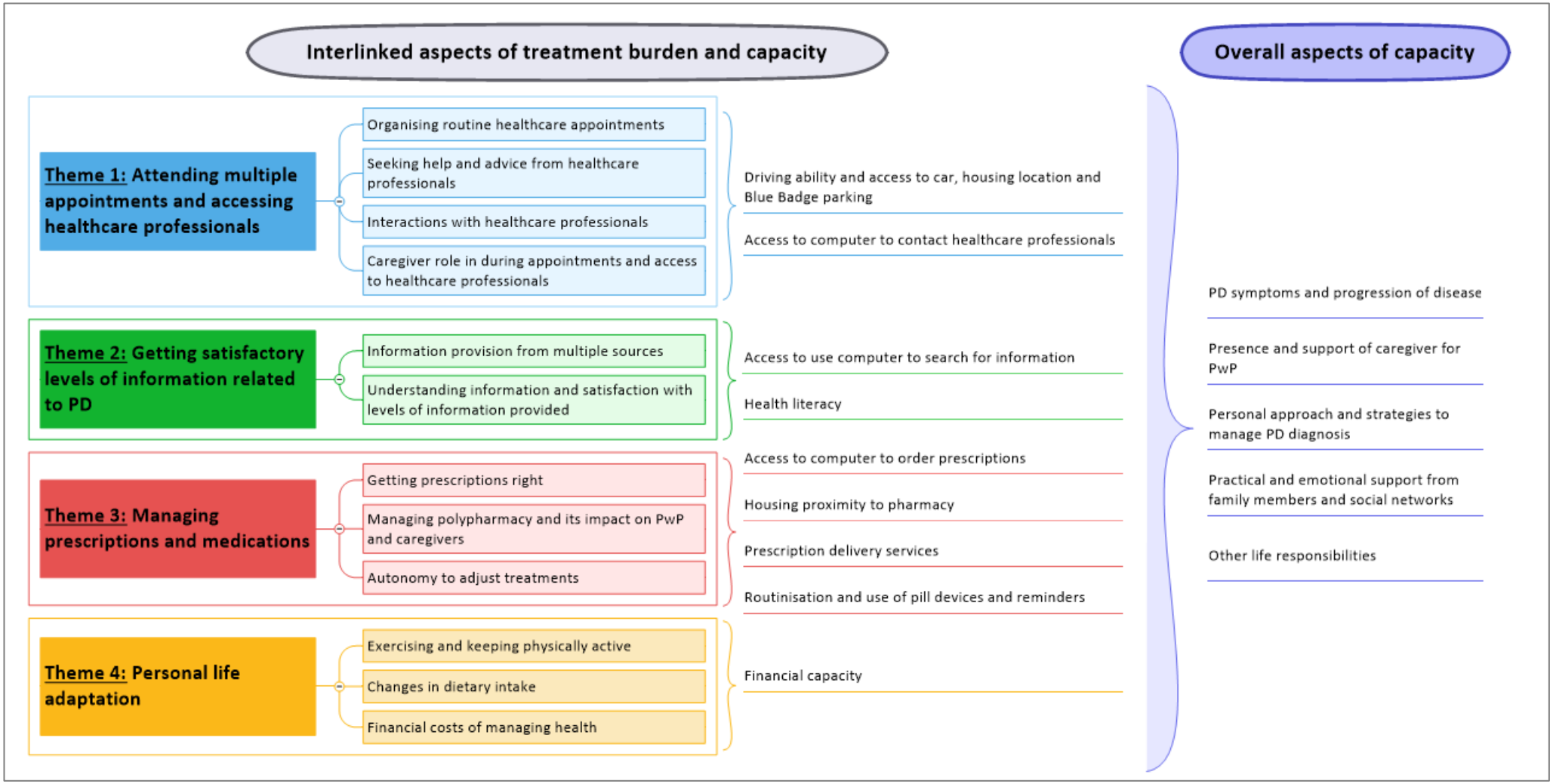


Figure 24: Interlinked aspects of treatment burden and capacity in Parkinson's Disease

4.4 Discussion

This study has highlighted the experiences of treatment burden and capacity in PD related to attending healthcare appointments, access to and interactions with healthcare professionals, obtaining satisfactory levels of information related to PD, managing prescriptions and polypharmacy, personal life adaptations and the importance of individual life circumstances when managing PD. These issues of treatment burden are closely interlinked, with one aspect potentially exacerbating another and adding to the overall burden. The treatment burden and capacity of PwP and caregivers are also closely intertwined in PD. The multitude of symptoms and inevitable progression of PD can impact both treatment burden and capacity of PwP and caregivers. There are potentially modifiable factors of treatment burden in PD such as changes in the frequency of healthcare appointments, improving access, care coordination, continuity of care and interactions with healthcare professionals, providing information regarding PD based on personal preferences and stages of PD, and reducing polypharmacy. There are also aspects of capacity that may be enhanced such as improving health literacy, health coaching to encourage change in personal approaches to PD such as maintaining positivity, and utilisation of practical strategies such as prescription delivery services, pill devices and the use of reminders to help manage the medication burden.

4.4.1 How does this compare with the systematic review findings?

The overlapping and contrasting issues of treatment burden between the systematic review and the four main themes described in the interview findings are summarised in Table 18 (page 189). From the systematic review and interviews, the treatment burden aspects related to appointments, information provision, and medications appear to be the most burdensome in PD. The interviews further support findings from the systematic review that symptoms and progression of PD can impact the treatment burden and capacity of PwP and caregivers. Whilst the interview findings can also relate to Eton's framework of treatment burden, it is difficult to separate the treatment burden in PD into three distinct issues (workload, challenges, impact) as described by the framework. Furthermore, although Eton's framework was useful in identifying the treatment burden in the systematic review, it does not fully describe the nuances of each aspect nor does it include the closely related aspects of patient capacity in PD as described in this chapter.

There were also differences between the systematic review and interviews as seen in Table 18, with issues of treatment burden in PD reported in the systematic review that was not described in interviews and vice versa. For example, issues with changes and arranging appointments were reported in the interviews, whilst difficulties with time, travel and transportation to appointments were reported in the systematic review. Similarly, issues with managing prescriptions were described in the interviews, but not reported in the systematic review. These differences may be explained due to the inclusion of articles from 19 different countries in the systematic review, whereas participants for the interviews were recruited from one region in the UK. The contrasting healthcare systems of the countries included in the systematic review compared to the NHS health system in the UK and the ongoing impact of the COVID-19 pandemic may account for the differences in findings. Furthermore, all interview participants were living at home whilst the systematic review included participants living in residential or nursing homes.

Table 18: Comparison of treatment burden issues between systematic review and interviews

Interview themes	Overlapping issues of treatment burden from interviews and systematic review	Novel issues of treatment burden from the interviews	Other issues of treatment burden from the systematic review
Theme 1: **Attending multiple appointments and accessing healthcare professionals**	• Organise and attend regular medical appointments with multiple healthcare professionals • Dissatisfaction with the frequency of follow-up appointments • Unsatisfactory interactions with healthcare professionals due to lack of patient-centred care, poor communication, lack of understanding, lack of empathy and lack of shared decision making • Lack of care coordination between PD and DBS team, GP and hospital, GP and PD team • Lack of continuity of care with GP and PD nurse specialist • Role of caregiver helping to communicate and raise issues with healthcare professionals • Impact of appointments on personal and social activities	○ Changes in appointments ○ Challenges arranging appointments ○ Impact of COVID-19 on appointments including cancelled or delayed appointments and changes to telephone appointments ○ Challenge of using online computer consultation to access GPs ○ Choosing not to seek help or advice from healthcare professionals between PD appointments ○ Difficulty accessing and poor relationship with GPs due to the perception of GP ability and time-limited appointment slots ○ Role of caregiver in reminding PwP of outcomes, contacting healthcare professionals on behalf of PwP during appointments	• Difficulties with time, travel, and transportation to appointments • Inflexible organisational structures of health and social care systems • Poor availability and lack of access to healthcare and social services • Poor service provision for severe PD • Challenges faced in care home or hospital settings

Theme 2: **Getting satisfactory levels of information related to PD**	• Obtaining information from multiple sources including healthcare professionals, family members and Parkinson's UK • Searching for information • Learning about PD, progression of PD, medications, medication side-effects, other health conditions, available resources, and services • Satisfaction with information provision regarding PD, symptoms of PD, PD progressions, prognosis with PD, medications, and how to care for someone with PD	○ Learning from own and other's experiences about how to manage PD ○ Ability to understand the information provided	• Uncertainty and contradicting information from healthcare professionals

Theme 3: **Managing prescriptions and medications**	• Managing polypharmacy for PD and other health conditions • Taking control of medication doses and timings based on symptoms response and daily activities • Routinisation and use of pill devices, reminders, and technology • Lack of response to PD medications, variable medication efficacy and unpredictable fluctuation of PD symptoms • Monitor response to medication changes and medication side-effects • Issues with medication adherence leading to delayed or missed doses • Impact of medications on daily activities • Side-effects of DBS treatment • Managing DBS adjustment and multiple appointments	○ Managing prescription errors from GPs, PD specialists and pharmacists ○ Delays in prescriptions ○ Issues with collecting prescriptions ○ Caregivers taking responsibility for medications due to PD symptoms and progression ○ Caregiver helping to charge DBS	• Frequent changes in medication doses and timings • Managing side-effects of PD medications
Theme 4: **Personal life adaptation**	• Attending physiotherapy and completing exercises • Managing changes in diet and interaction with PD medications • Expenses related to travel to appointments, equipment, mobility aids, lifestyle changes, and practical support for daily activities	○ Financial cost of home adaptations	• Taking extra supplements • Financial costs of medications • Potential loss of financial income and lack of insurance coverage, lack of financial support and delays from health and social care support

4.4.2 How does this compare with the literature?

Some of the main issues of treatment burden from the interviews with PwP and caregivers relating to medications, information provision and access and interactions with healthcare services align with findings from the systematic review and were previously discussed in Section 3.5 (page 139). These findings are consistent with treatment burden literature in other LTCs such as stroke, heart failure, chronic kidney disease, COPD, lung cancer, and type 2 diabetes mellitus(77, 101, 103, 108, 302). However, the interviews reported additional issues of treatment burden in PD related to managing prescription errors, medication availability, collecting prescriptions, difficulties accessing GP, as well as the limited appointment lengths with their GP. These resonate with the experiences of treatment burden of patients with stroke and chronic kidney disease living in the UK(77, 108). PwP and caregivers also reported difficulties understanding information provided to them, with factors such as previous occupation and family support contributing to their ability to understand information related to health. Health literacy can therefore also be construed as an important aspect of patient capacity(76). A Danish population-based study in multimorbid patients with cardiovascular disease reported that treatment burden levels are high in those with low health literacy(112). Limited health literacy was also strongly associated ($p<0.001$) with high treatment burden in a cross-sectional survey of patients with multimorbidity in the UK(113).

A novel finding from the interviews was the impact of the COVID-19 pandemic on the treatment burden in PD. PwP and caregivers reported cancelled or delayed appointments, and changes to telephone appointments which contributed to their treatment burden. There was dissatisfaction with telephone appointments due to the lack of physical assessment of symptoms, issues with communication, and lack of rapport and relationship building with healthcare professionals. This aligns with findings from a large Parkinson's UK national survey (N=1491) that found that 34% of participants had their appointments with the PD specialist or PD nurse specialist cancelled, with more than half not offered a telephone or online appointment(303). The negative experiences with telephone appointments described in this study were also reported in the Parkinson's UK survey as well as other studies with PwP(303-305). In contrast, a large mixed-methods implementation study in Canada reported that the use of virtual visits in primary care may have the potential to reduce the treatment burden related to medical appointments and monitoring health status(306). The appropriate delivery of telemedicine as an adjunct or additional service for clinicians may in fact be beneficial to some PwP as it is more convenient with reduced travel

time and costs as well as more accessible for those with severe disability, homebound or living in rural areas(304).

The findings from this study suggest that there is a close relationship between the treatment burden and capacity in PD. Additionally, successfully managing the treatment burden may in fact enhance patient capacity in PD. For example, adherence to PD medications and receiving input from physiotherapy and occupational therapy can help symptom control and increase the physical ability of PwP. Furthermore, PD symptoms and progression appear to have an impact on both these concepts. The worsening tremor and deteriorating mobility may lead to increasing medication doses or timings in PD, whilst fatigue associated with PD can impact on their ability to complete recommended exercises. PD symptoms such as poor dexterity and deteriorating memory can influence their ability to organise medications and access healthcare professionals. This aligns with the Cumulative Complexity Model which proposed that shouldering the treatment workload of a chronic condition necessitates sufficient capacity (see Section 1.5.1, page 43)(76). Physical and mental capacity are important facets that contribute to treatment burden and capacity(76). Studies in other chronic conditions such as HIV and chronic kidney disease have highlighted the impact of symptoms such as fatigue, pain, anxiety and depression on treatment burden and capacity(110, 297). In heart failure, symptoms appear to predominantly impede patients' engagement with self-care, through overwhelming treatment burden(307). A recent scoping review reported that poor physical and mental health was a barrier for PwP in accessing healthcare as it negatively affects their ability to engage with healthcare services, adhere to treatment, and actively participate in patient-centred care(308).

The individual life circumstances, personal approach, and strategies adopted by PwP and caregivers are other aspects of capacity that help them manage the treatment burden in PD. This study suggests that participants with a recent diagnosis of PD may feel burdened due to the shock of receiving a progressive incurable disease, the steep learning curve, frustration regarding symptom control, medication use, and the need to navigate the healthcare system. Comparatively, participants living with PD for more than five years were more likely to describe being attuned to the variability and unpredictability of PD, learning to take each day as it comes. PwP and caregivers may adapt their personal or social daily activities and instead prioritise their lives around the tasks required for their health with PD such as taking medications or attending healthcare appointments(309). Therefore, the workload of managing PD may not be perceived as burdensome and instead accepted as part of their daily routines as the years progress. A qualitative systematic review of treatment burden across a range of LTCs but not PD described this as ‘adaptive treatment work’, where patients and families look to normalise and embed treatments in their lives(81). These findings also closely relate to the Theory of Patient Capacity

previously described in Section 1.7 (page 53) which theorised patient capacity relies on one's biography, resources, environment, the realisation of work, and social functioning(105). Capacity is not a static entity but rather a dynamic concept that can be influenced by psychological and social factors and varies depending on personal experiences and situations(103, 105). Furthermore, a recent qualitative study involving interviews with patients with heart failure also reported that personal characteristics and coping strategies were the main themes of patient capacity, aligning with aspects of capacity in PD reported in this study(107).

The presence of a caregiver for the person with PD appears to be a fundamental aspect of patient capacity. Caregivers also experienced treatment burden when supporting someone with PD to manage their health by attending appointments together, managing medications, learning about PD, and enacting lifestyle changes. Support from caregivers could minimise the impact on patients' stress when managing frequent appointment changes, leaving the question as to what may happen if a person with PD does not have that support. Furthermore, the presence of cognitive impairment and dementia may mean that the person with PD may not be able to manage the workload of healthcare themselves, relying instead on their caregiver to complete these tasks. This suggests that the caregiver treatment burden may be exacerbated as PD progresses, aligning with findings from a qualitative study exploring treatment burden among caregivers of older adults with diabetes and co-morbid dementia(310). A mixed-methods study described the role that caregivers of PwP in the palliative phase of PD have in arranging, coordinating and organising healthcare, with a lack of information about available healthcare services, and lack of support from healthcare professionals(309). Caregivers must manage this on top of providing physical, social, and emotional support, potentially assisting with personal care and activities of daily living as well as managing other life demands such as employment(133, 310, 311). This can be extremely demanding and challenging, and may also contribute to the caregiver burden in PD(84). Support from social networks for PwP and caregivers may mitigate this and enhance their capacity(297).

Other aspects of capacity in PD such as access to transportation, use of technology, prescription delivery services, health literacy, financial capacity, the proximity of living location and support from various social networks resonate with other studies(105, 108). Boehmer et al's review reported that patient capacity is an accomplishment of interaction with the process of rewriting one's biography, utilisation of available resources, healthcare, and self-care tasks, one's environment and presence of social networks(105). A UK study in older people with chronic kidney disease highlighted components of capacity that include pragmatic skills such as internet use, car ownership, geographical location to hospitals, practical support from family and friends for transportation or getting medications, and health literacy(108). Having additional practical

support for the activities of daily living may increase the ability of PwP and caregivers to complete the tasks required for PD such as taking multiple medications and attending appointments.

4.4.3 Strengths and Limitations

To the best of my knowledge, this is the first primary qualitative study to explore the treatment burden and capacity of PwP and caregivers specifically. A strength of this study is the inclusion of participants with a range of characteristics with limited exclusion criteria. Purposive sampling for the interviews led to the inclusion of participants living with mild, moderate, and severe PD (including PD dementia) over a wide range of years. Caregivers included spouses or partners who cohabited with the person with PD, as well as non-spousal caregivers who did not live with the person with PD. However, the interviews have several limitations. Firstly, participants were recruited from two local hospitals in Southern England. Although the UK national census in 2011 reported that the majority of the Hampshire population (89%) identified as White British, the lack of non-white ethnic participants in this study may be a limitation(312). Parkinson's UK estimates that approximately 7.1% of PwP in the UK are from minority ethnic backgrounds(313). Secondly, data related to financial status or deprivation levels were not obtained, although most participants included appeared to have affluent backgrounds. These may be important factors that influence the experiences of participants living with PD and is, therefore, a limitation of the interviews. Thirdly, participants who may have higher treatment burden or less capacity may not have consented to interviews due to limited time constraints when trying to manage their health with PD. This may have led to further aspects of treatment burden and capacity that are not reported in the interview findings. However, the integration of findings from the systematic review mitigates this limitation.

4.5 Conclusion

There are potentially modifiable factors that could reduce the treatment burden or enhance the capacity of PwP and caregivers living with PD. The treatment burden and capacity in PD are closely interlinked. Both PwP and their caregivers experience treatment burden with many factors influencing their capacity to manage the treatment burden. Interventions from healthcare professionals adopting a patient-centred approach could reduce the treatment burden and enhance the capacity of PwP and caregivers, leading to better health outcomes.

4.6 Implications and Next Steps

Findings from Work Packages 1 and 2 have identified the key factors of treatment burden and capacity in PD. The main issues of treatment burden relate to medications, healthcare appointments and information provision. However, this was an initial exploratory study in a small sample of PwP and caregivers and the findings of the interviews are not intended to be generalisable to a larger population of PD. Furthermore, the extent and levels of treatment burden in PD have not been determined. Therefore, Work Package 3 of this study involved the development of a survey to measure the treatment burden levels in PD and determine the associated factors that influence treatment burden at a national level. This is described in the next chapter. The published paper from the interviews is shown in Appendix K (see page 361).

Chapter 5 Work Package 3 – Cross-Sectional National Survey

5.1 Introduction to Chapter

This chapter describes Work Package 3 of The PD Life Study which involved a cross-sectional national survey with PwP and caregivers, building on findings from the systematic review (Chapter 3) and interviews (Chapter 4).

5.1.1 Rationale

Findings from the systematic review and interviews have highlighted the issues of treatment burden experienced by PwP and caregivers when managing their health and the multiple motor and non-motor symptoms (NMS) with PD. These include managing polypharmacy, attending healthcare appointments, dissatisfaction with the frequency of appointments, access and interactions with healthcare professionals, adequate information provision, and personal life adaptations such as diet and exercise. On top of this, PwP may also have co-existing frailty or multimorbidity (two or more LTCs) which can potentially add to the treatment burden. However, none of the qualitative articles included in the systematic review explored treatment burden as the primary aim. Additionally, the interviews with PwP and caregivers were conducted in a small sample recruited from two PD outpatient clinics in Southern England with little diversity. No previous studies have quantified the treatment burden among PwP and their caregivers or explored the associations of frailty and multimorbidity on treatment burden in PD. The Multimorbidity Treatment Burden Questionnaire (MTBQ) has been validated in older people with multimorbidity living in the UK but has not yet been used specifically in PD(80). Therefore, in Work Package 3, a national survey building on findings from Work Packages 1 and 2 was conducted to enable the exploration of treatment burden and capacity across a larger UK-wide population cohort of PwP and caregivers.

5.1.2 Aim

The survey was conducted among PwP and caregivers to quantify the extent and levels of treatment burden (using the MTBQ) and explore the associations of key factors with treatment burden including frailty and multimorbidity.

5.2 Methods

5.2.1 Participant Recruitment and Sampling

Participants were recruited via two methods: 1) with support from Parkinson's UK and 2) from PD outpatient clinics. Inclusion criteria were adult participants (age >18 years) who had a diagnosis of PD or was a caregiver for someone with PD, and were able to consent to participate. Participants were excluded if they could not consent to participate. No incentives were provided for completing the survey. Parkinson's UK supported recruitment for the national survey on their Research Support Network and Take Part Hub, a UK-wide network that shares research opportunities with approximately 6500 PwP and caregivers who are interested in participating in a range of research studies. Parkinson's UK reported that results from their last survey of 953 people in the Research Support Network that 81% of their network members have PD, with an equal gender distribution amongst members, and 95% identifying as 'White British' or 'White Other'. A link to the participant information sheet and online surveys was advertised via the Parkinson's UK website. Recruitment of participants through Parkinson's UK enabled participation from PwP and caregivers across the UK. PwP and caregivers attending two PD outpatient clinics in Hampshire and Dorset were approached following consent from their PD specialist. Interested participants were given a brief explanation of the study and a survey pack containing a participant information sheet, survey booklet, return envelopes and study results. The paper survey also included the link to the online survey if participants opted to complete the survey online. Participants were asked to tick a box to confirm that they have read the participant information sheet and consented to participate at the start of the survey.

Sample size calculations were not appropriate for this study, as it does not intend to conclusively determine causations or predictive aspects of treatment burden in PD. Rather, this was an initial exploratory study on a subject not previously researched. The Dorset Treatment Burden Survey conducted among older people with multimorbidity sample size calculation estimated at least 300 survey responses would be required to identify those with high treatment burden levels based on

a 27% prevalence for high treatment burden from the MTBQ validation study data(113). The study aimed to achieve up to a maximum of 500 respondents to the surveys cumulatively from both online and paper formats as an initial pragmatic sample. The maximum sample size was predetermined by the research team and corresponded with the license for use of a validated measure of QoL within the survey.

5.2.2 Data Collection

Two separate surveys, one for PwP and one for caregivers were created (see Appendix K, page 361 and Appendix L, page 395) with matching questions where possible. The surveys were piloted with our PPI group and took approximately 20-30 minutes to complete. Methods for the survey creation and justification for the chosen validated measures were previously described in Section 2.8.1 (page 92). All data were self-reported. Table 19 summarises the survey questions.

Table 19: Questions included in the surveys for people with Parkinson's disease and their caregivers

Questions included in the surveys
Sociodemographic data, PD and overall health characteristics including length of PD diagnosis, PD severity using H&Y staging(stages 1-5), Non-Motor Symptoms Questionnaire (NMSQuest) for PwP and self-reported other LTCs were collected(33, 205).
Frailty was assessed using the Program of Research to Integrate Services for the Maintenance of Autonomy (PRISMA-7), a self-reported questionnaire with scores of ≥3 indicative of frailty(218).
Health-related quality of life was measured using the Medical Outcomes Study Short Form version 2 (SF12v2). A licensed software was obtained from Qualitymetric© to generate two mean scores: 1) physical component summary (PCS) and 2) mental component summary (MCS). These mean scores are compared to the general adult population norm in the USA, with higher scores indicative of better health(225).
Data related to recognised aspects of treatment burden and capacity in people with LTCs and findings from the systematic review and interviews were collected including medication and prescription management, information provision and health literacy, healthcare service access and use, and access to car and technology.
Health literacy was assessed using the single-item literacy score (SILS): *"How often do you need someone to help you when you read instructions, pamphlets, or other written material from your doctor or pharmacy?"*. The SILS is scored on a 5-point Likert scale with responses 'sometimes', 'often' and 'always' indicative of limited health literacy(231).

Treatment burden levels were measured using the validated 13-item MTBQ (see Appendix A, page 305) in the PwP survey and the 16-item caregiver MTBQ (see Appendix C, page 311) in the caregiver survey(80). Scores for each MTBQ item range from 0 (not difficult/does not apply) to 4 (extremely difficult) with global treatment burden levels (0-100) calculated (see Section 2.8.2, page 100).
A single-item treatment burden measure initially developed in the Dorset Treatment Burden Survey which was then refined further was included for further evaluation: "*Have you felt overstretched by everything you've had to do to manage your health in the last month (e.g. taking medications, getting prescriptions, attending appointments)?"*(113).
Caregiver burden was measured using the 12-item Zarit Burden Interview (ZBI-12) with responses scored from 0 (never) to 4 (nearly always). Higher total scores indicate higher caregiver burden levels(234).

The online survey using the SmartSurvey platform was open for data collection through the Parkinson's UK Take Part Hub website from September 2021 to January 2022. A total of 71 survey packs were distributed at 13 PD outpatient clinic sessions between October and December 2021. All paper survey responses were manually double-entered by a medical student undertaking a BMedSci project, a research assistant, and myself onto the SmartSurvey platform. All survey data were then exported from the SmartSurvey platform and imported onto a Microsoft® Excel® (Microsoft 365 Apps for enterprise, version 16.0) data spreadsheet using standard import routines available within Excel® for data cleaning. Data were then exported onto the IBM Statistical Product and Service Solutions (SPSS) software for Windows version 28 (IBM Corporation, New York) data spreadsheet where data were re-coded before statistical analysis.

5.2.3 Data Analysis

The methodological considerations for the data analysis of the surveys were previously discussed in Section 2.8.2 (page 100).

5.2.3.1 Participant Characteristics

Statistical analysis was conducted using SPSS. PwP and caregiver surveys were analysed separately. Descriptive statistics using median (interquartile range (IQR)), mean (standard deviation (SD)) and number (%) were used to analyse participant characteristics and measured aspects of treatment burden and capacity. All continuous variables were checked for evidence that they were approximately normally distributed using histograms. Self-reported LTCs other

than PD for the person with PD were categorised using the International Classification of Diseases 11th (ICD-11) revision standard for diagnostic health information(314).

5.2.3.2 Treatment Burden Levels

Global MTBQ scores were calculated as per Duncan et al using the following steps(80):-

1) Recode all "does not apply" and "not difficult" = 0, "a little difficult" = 1, "quite difficult" = 2, "very difficult" = 3 and "extremely difficult" = 4.
2) Exclude participant responses if more than 50% of their responses are missing.
3) Calculate each participant's average score from the questions answered.
4) Multiply the average score by 25 to give a global MTBQ score from 0-100.

Treatment burden levels were then categorised into 'no burden' (score =0), 'low burden' (score <10), 'medium burden' (score 10-21) and 'high burden' (score ≥22)(80). Participants with no and low burdens were combined into one group, and those with medium and high burdens were combined into another group. This grouping was decided following discussions with my supervisors and felt to be appropriate from a clinical perspective as PwP and caregivers due to the inevitable progression in PD. Recognition of PwP and caregivers with both medium and high treatment burden levels who may be at risk of poor health outcomes may lead to early interventions or changes in management that may prevent increasing treatment burden levels, or in fact reduce treatment burden levels. This was also a pragmatic decision to allow for the exploration of associations due to the small number of PwP with high treatment burden (N=34). Other larger studies using the MTBQ in patients with multimorbidity have conducted binary logistic regression using 'no/low/medium' burden vs 'high' burden in their analysis(112, 113).

Comparison of participant characteristics conducted between those with 'no/low' burden and 'medium/high' burden groups for PwP and caregivers were analysed using independent t-test, Mann-Whitney U test, Pearson Chi-Square test, Fischer's exact test, or Likelihood ratio, choosing the test according to the distributional properties of each variable. Responses on each MTBQ item that scored at least one point were recoded 'difficult' (combining responses 'a little difficult', 'quite difficult', 'very difficult' and 'extremely difficult') or 'not difficult' (combining responses 'not difficult' and 'does not apply')(113). A comparison of 'no/low' burden vs 'medium/high' burden groups with 'difficult' responses for each item of the MTBQ for PwP and caregivers was also conducted. Data were analysed descriptively using frequencies and proportions. The association between relevant treatment burden items on the MTBQ with measured aspects of treatment burden (prescription and medications, information provision, and healthcare service use) were

analysed using univariable binary logistic regression using MTBQ dichotomised responses ('difficult' vs 'not difficult') as the dependent variable. Caregiver responses on each item of the ZBI-12 were dichotomised to compare caregivers who scored at least one point (combining responses 'rarely', 'sometimes', 'quite frequently' and 'nearly always') to those who responded 'never'. Comparison between responses for each item of the ZBI-12 and caregivers with 'no/low' and 'medium/high' burden were analysed descriptively using percentages and proportions.

5.2.3.3 Factors Associated with Treatment Burden

Univariable binary logistic regression was conducted to explore the association of a range of variables that may contribute to treatment burden levels for PwP. This was not conducted for caregivers due to the small sample size (N=30). A binary outcome of medium/high burden vs no/low burden was used for the reasons described above. H&Y stages 4 and 5 were combined into one category and Table 20 summarises the variables that were dichotomised prior to analysis due to small sample sizes within categories (unless otherwise stated):

Table 20: Variables that were dichotomised prior to data analysis

Variable	Dichotomised categorisation prior to data analysis
Marital status	Married/civil partnership vs single/divorced/dissolved civil partnership/widowed
Employment status	Employed vs Unemployed/retired
Total healthcare service use for PD in the last 12 months	0-2 vs ≥3 times, as according to NICE UK PD guidelines, PwP should be reviewed at regular intervals of 6 to 12 months(20).
Presence of frailty	Yes vs No
Self-reported other long-term conditions (LTC)	0-1 vs ≥2 other LTC was decided using the definition of multimorbidity(35). PwP who did not respond to this question (missing data) were recoded as having '0' other LTC.
Frequency of medications	0-3 vs >3 times a day was decided as levodopa is considered optimal first-line treatment in PD and is often advised to be taken three times a day initially(29).

Variables included in the multivariable logistic regression stage were decided prior to analysis based on known associations with treatment burden from previous studies (age, number of

medications, number of LTCs) and those hypothesised to be clinically relevant (health and PD characteristics). Variables found to have p≤0.25 at the univariable analysis stage were also included at the multivariable stage. The relaxed p-value criterion for inclusion into the multivariable model was decided due to the limited sample size in relation to the variables explored(238). This allowed the reduction of the initial number of variables in the multivariable model and decreased the risk of missing potentially important variables(236, 238).

From the final list of variables, four independent multivariable logistic regression models were determined (see Table 21) based on clinical knowledge and previous treatment burden literature(239). Whilst statistical significance was set at $p<0.05$, the study was not conducted to test the null hypothesis of associations between variables and treatment burden outcomes. Therefore, the attainment or otherwise of the p-value target should not be viewed as a pass or fail result. But rather, the confidence intervals provided give a more nuanced understanding to reflect the precision of the estimated associations.

Table 21: Independent multivariate logistic regression models conducted

Model number	Variables Included
Model 1	Sociodemographic factors including age, gender, living property and employment.
Model 2	Sociodemographic factors and health characteristics including the number of other long-term conditions (LTCs) and frailty
Model 3	Sociodemographic factors and PD characteristics including length of PD diagnosis, PD severity, and PD NMSQuest scores
Model 4	Non-modifiable variables which included sociodemographic factors, those reporting needing help on a regular basis, PD characteristics and number of other LTCs

5.2.3.4 Evaluation of the Single-item Treatment Burden Measure

As this was an exploratory question, the analysis was conducted to evaluate the usefulness of the single-item treatment burden measure in discriminating between those with 'medium/high' burden and 'no/low' burden and between those with 'high' burden and 'no/low/medium' burden. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and positive likelihood ratio were calculated. A receiver operating characteristic curve (ROC) was plotted and area under the curve (AUC) was estimated to assess the accuracy of the single-item

treatment burden question. The usefulness of the single-item measure for caregivers was not analysed due to the small sample size.

5.3 Results

A total of 162 PwP surveys were completed, 19 on paper and 143 online. Two PwP responses were excluded due to >50% missing data on the MTBQ, leaving a total of 160 valid respondents. Thirty caregiver surveys were completed, 12 on paper and 18 online. Responses were received from across all regions in the UK (see Table 22).

Table 22: Survey responses across the UK regions

Variables		PwP	Caregivers
Number of Participants, N		160	30
Region of UK, N (%)	*Missing data*	5 (3%)	-
	Northern England	19 (12%)	3 (10%)
	Midlands	19 (12%)	2 (7%)
	East of England	17 (10%)	1 (3%)
	London	8 (5%)	2 (7%)
	South of England	71 (44%)	20 (67%)
	Scotland	14 (9%)	-
	Wales	4 (3%)	2 (7%)
	Northern Ireland	3 (2%)	-

The results are reported in the following subsections:-

- Section 5.3.1 reports the participants' characteristics.
- Section 5.3.2 describes treatment burden levels and MTBQ responses for participants.
- Section 5.3.3 will report the factors associated with treatment burden for PwP.
- Section 5.3.4 describes the evaluation of the single-item treatment burden measure.

5.3.1 Participant Characteristics

This section reported participants' characteristics which include: 1) sociodemographic data, 2) PD and overall health characteristics, and 3) reported aspects of treatment burden and capacity.

5.3.1.1 Sociodemographic Data

Full sociodemographic data for participants can be seen in Table 23. In summary, the mean ages of PwP and caregivers were similar. There was a fairly equal number of male and female PwP, whilst the majority of caregivers were female. Nearly all participants were of white ethnicity. The majority of participants were married or in a civil partnership, cohabiting, living in a property they owned, retired, and achieved education levels equivalent to or higher than A levels. PwP-caregiver relationships were predominantly spouses/partners. Most PwP reported requiring help regularly, whilst only a few caregivers reported requiring help regularly for themselves. A few PwP reported having paid carer and a few caregivers reported that the person with PD they cared for also had a paid carer.

Table 23: Self-reported Sociodemographic Data

Variables		PwP (N = 160)	Caregivers (N = 30)
Mean age, years (SD)		67.6 (8.2)	68.7 (8.9)
Gender, N (%)	Male	76 (48%)	8 (27%)
	Female	84 (52%)	22 (73%)
Ethnicity, N (%)	*Missing data*	1 (1%)	-
	White	158 (98%)	30 (100%)
	Non-white	1 (1%)	-
Marital status, N (%)	*Missing data*	1 (1%)	-
	Single	11 (7%)	1 (3%)
	Married/ civil partnership	126 (79%)	28 (94%)
	Divorced/ dissolved civil partnership	15 (9%)	1 (3%)
	Widowed	7 (4%)	-
Living situation, N (%)	*Missing data*	1 (1%)	-
	Alone	21 (13%)	1 (3%)
	With spouse/partner or family member	138 (86%)	29 (97%)
Living property , N (%)	Own	140 (88%)	29 (97%)
	Rented	15 (9%)	1 (3%)
	Relative's Home	3 (2%)	-

	Friend's Home	2 (1%)	-
Living area, N (%)	*Missing data*	2 (1%)	-
	Urban	29 (18%)	8 (27%)
	Suburban	63 (40%)	14 (46%)
	Rural	66 (41%)	8 (27%)
Employment status, N (%)	Employed	25 (16%)	3 (10%)
	Unemployed	9 (3%)	2 (7%)
	Retired	126 (79%)	25 (83%)
Given up employment due to PD or caring, N (%)	*Missing data*	1 (1%)	-
	Yes	40 (25%)	4 (13%)
	No	119 (74%)	26 (87%)
Highest education level, N (%)	*Missing data*	1 (1%)	1 (3%)
	Degree level or above	91 (57%)	8 (27%)
	A level or equivalent	35 (22%)	10 (33%)
	GCSE level or equivalent	23 (14%)	8 (27%)
	No qualification	10 (6%)	3 (10%)
Relationship of main person who helps or supports PwP, N (%)	Spouse/Partner	118 (74%)	29 (97%)
	Family	15 (9%)	1 (3%)
	Friend	2 (1%)	-
	Help not required	23 (15%)	
	Other	1 (1%)	
Requiring help on a regular basis, N (%)	*Missing data*	1 (1%)	1 (3%)
	Yes	116 (73%)	3 (10%)
	No	43 (26%)	26 (87%)
Presence of paid carer for PwP, N (%)*	*Missing data*	1 (1%)	1 (3%)
	Yes	4 (2%)	5 (17%)
	No	155 (97%)	24 (80%)
Presence of paid carer for caregiver, N (%)	*Missing data*		1 (3%)
	Yes		1 (3%)
	No		28 (94%)

*SD; Standard deviation, *Caregiver reported regarding the person with PD they care for*

5.3.1.2 Parkinson's Disease and Overall Health Characteristics

As summarised in Table 24 (page 209), the median length of PD diagnosis was 5 (IQR 3-8) years for PwP, with a majority reporting H&Y stages 1-3. In comparison, caregivers reported that the person with PD they care for had a median length of PD diagnosis of 10 (IQR 6-15) years with 40% caring for someone with H&Y stage 4-5. The median PD NMSQuest score for PwP was 9 (IQR 3-8).

The majority of caregivers reported issues with mood, memory, and hallucinations for the person with PD in the last 12 months. There were fairly high proportions of PwP with two or more other LTCs, with the majority of caregivers themselves also reporting having two or more other LTCs. More PwP had frailty compared to caregivers.

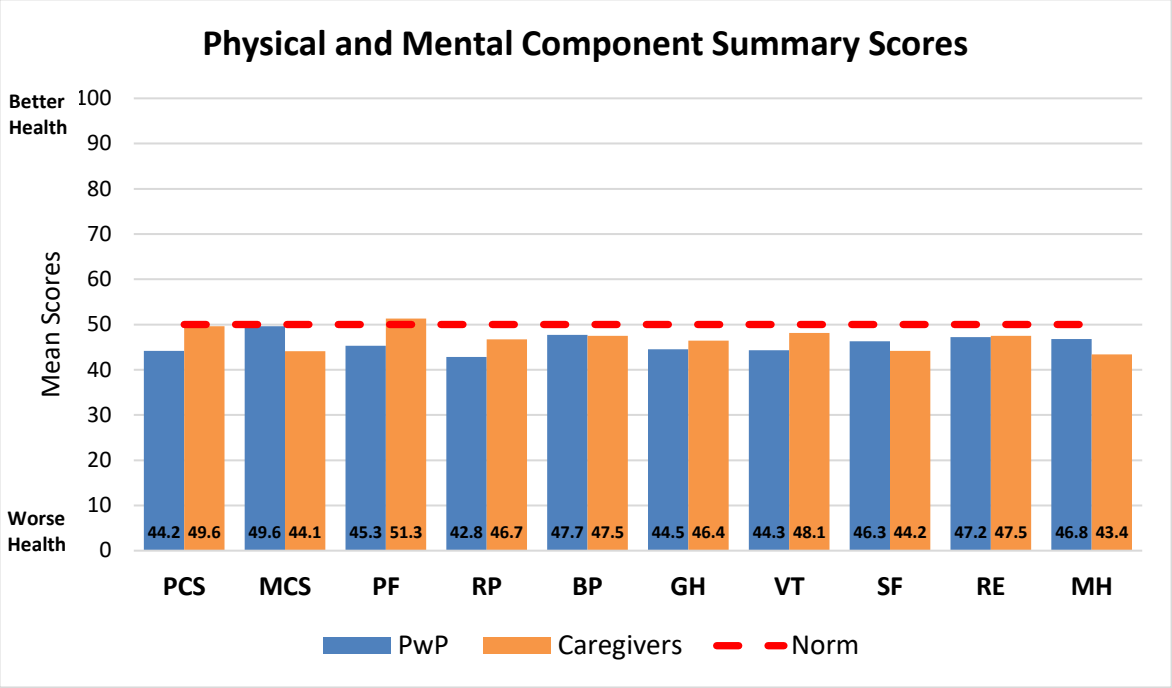
Table 24: Self-reported Health and Parkinson's Disease Characteristics

Variables		PwP	Caregivers
Median length of PD diagnosis, years (IQR)* *Missing data =*		5 (3-8) 6	10 (6-15) 1
PD severity (H&Y stage)*	*Missing data*	-	1 (3%)
	Mean (SD)	2.0 (1.0)	3.1 (1.4)
	Stage 1	76 (47%)	7 (23%)
	Stage 2	20 (13%)	1 (3%)
	Stage 3	55 (34%)	9 (30%)
	Stage 4	8 (5%)	7 (23%)
	Stage 5	1 (1%)	5 (17%)
Median PD NMSQuest score, (IQR)		9 (6-13)	
Caregiver reported presence symptoms in the person with PD in the last 12 months, N (%)	Mood		22 (73%)
	Memory		22 (73%)
	Hallucinations		15 (50%)
PwP reported number of other long-term conditions, N (%)*	*Missing data*	18 (11%)	8 (27%)
	0	24 (15%)	1 (3%)
	1	45 (28%)	2 (7%)
	2	32 (20%)	10 (33%)
	≥3	41 (26%)	9 (30%)
Caregiver reported number of long-term conditions, N (%)	*Missing data*		3 (10%)
	0		2 (7%)
	1		7 (23%)
	2		8 (27%)
	≥3		10 (33%)
Frailty, N (%)	Yes	74 (46%)	4 (13%)
	No	86 (54%)	26 (87%)
Mean Physical Component Summary (PCS) score (SD)		44.2 (10.3)	49.6 (11.4)
PCS scores compared to general population norm, N (%)	*Missing data*	2 (1%)	-
	Above	29 (18%)	13 (43%)
	At	52 (32%)	8 (27%)
	Below	78 (49%)	9 (30%)
Mean SF12v2 Mental Component Summary (MCS) score (SD)		47.2 (9.7)	44.1 (10.5)

MCS scores compared to general population norm, N (%)		*Missing data*	2 (1%)	-
		Above	40 (25%)	6 (20%)
		At	60 (38%)	11 (37%)
		Below	58 (37%)	13 (43%)
Mean Norm-Based Score for SF12v2 domains (SD)	**Physical Components**	Physical Functioning	45.3 (10.3)	51.3 (8.5)
		Role-Physical	42.8 (9.8)	46.7 (10.4)
		Bodily Pain	47.7 (10.6)	47.5 (13.3)
		General Health	44.5 (11.1)	46.4 (9.6)
	Mental Components	Vitality	44.3 (9.9)	48.1 (13.0)
		Social Functioning	46.3 (10.0)	44.2 (12.5)
		Role-Emotional	47.2 (10.4)	47.5 (8.4)
		Mental Health	46.8 (9.5)	43.4 (10.9)
Median ZBI-12 score (IQR)				18.5 (8.8-27.5)

*H&Y; Hoehn and Yahr, IQR; interquartile range, NMSQuestion; Non-Motor Symptoms Questionnaire, SD; standard deviation, SF12v2; Medical Outcomes Study Short Form version 2, *Caregiver reported regarding the person with PD they care for*

Overall mean QoL scores for PwP and caregivers were marginally lower compared to the generalised USA adult population (mean = 50 (SD 10)). PwP had lower PCS scores and higher MCS scores compared to caregivers. A comparison between the mean PCS, MCS, and all eight domains (physical functioning (PF), role limitations due to physical restrictions (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role limitations due to emotional issues (RE) and mental health (MH)) of the SF12v2 for PwP and caregivers against the mean general USA adult population norm can be seen in Figure 25 (page 211), with higher scores indicating better health.



PCS; Physical Component Summary, MCS; Mental Component Summary, PF; Physical Functioning, RP; Role-Physical, GH; General Health, BP; Bodily Pain, VT; Vitality, SF; Social Functioning, RE; Role-Emotional, MH; Mental Health.

Figure 25: SF12v2 scores for People with Parkinson's and Caregivers Compared to Population Norm

There was a wide range of other LTCs as reported by PwP and caregivers about the person with PD. This is categorised based on ICD-11 classifications and shown in Table 25. Most commonly reported other LTCs for PwP related to 'diseases of the circulatory system' and 'diseases of the musculoskeletal system or connective tissues'. Hypertension (PwP=24%, Caregiver reported=14%) and osteoarthritis (PwP=20%, Caregiver reported=14%) were the two most reported physical conditions for the person with PD. The most reported mental conditionby PwP was depression (6%).

Table 25: List of self-reported other long-term conditions for People with Parkinson's based on ICD-11 classifications

Self-reported other long-term conditions for PwP based on the International Classification of Diseases (ICD-11)†	PwP, N (%)	Caregiver reported, N (%)
Diseases of Circulatory System	57 (36%)	6 (20%)
Diseases of the Musculoskeletal System or Connective Tissue	54 (34%)	8 (26%)
Endocrine, Nutritional or Metabolic disease	22 (14%)	2 (6%)
Diseases of Respiratory System	16 (10%)	3 (9%)

Diseases of Digestive System	15 (9%)	2 (6%)
Diseases of the Genitourinary system	15 (9%)	3 (9%)
Diseases of Visual System	12 (8%)	2 (6%)
Neoplasms	2 (1%)	2 (7%)
*Diseases of Nervous System/ Neoplasms	10 (6%)	2 (6%)
*Diseases of Ear or Mastoid Process/ Diseases of Skin/ Diseases of the Immune System/ Conditions related to Sexual Health/Other	9 (6%)	0

**Combined due to small numbers to reduce the potential for identification*

5.3.1.3 Aspects of Treatment Burden and Capacity

The measured aspects of treatment burden and capacity include:- 1) medication and prescription management, 2) information levels and health literacy, 3) access and use of healthcare services access and use and 4) access to car and technology.

5.3.1.3.1 Medication and Prescription Management

PwP reported taking a median of 4 (IQR 2-7) medications, with the frequency of medications a median of 4 (IQR 4-5) times a day. Almost half of PwP reported that they took ≥ 5 medications. Caregivers reported that the person with PD they cared for took a median of 6 (IQR 4-9) medications a day and the majority of caregivers reported that the person with PD took ≥ 5 medications. Data on the frequency of medications reported by caregivers was not collected. A smaller proportion of PwP reported needing help with medications, whilst the majority of caregivers reported helping the person with PD with their medications. PwP used a range of methods to help with their medications. The majority of PwP were able to collect their prescriptions from the pharmacy. In comparison, most caregivers reported collecting prescriptions for the person with PD. Table 26 summarises these findings.

Table 26: Self-reported Prescription and Medication Management

Variables		PwP	Caregivers
Median number of medications taken by PwP (IQR)*		4 (2-7)	6 (4-9)
Missing data =		3	-
Number of medications taken by PwP, N (%)	*Missing data*	3 (2%)	-
	0-1 medications	13 (8%)	3 (10%)
	2 medications	30 (19%)	2 (7%)

	3 medications	15 (9%)	2 (7%)
	4 medications	26 (16%)	2 (7%)
	≥ 5 medications	73 (46%)	21 (69%)
Median frequency of medication times a day (IQR)* *Missing data =*		4 (3-5) 4	
PwP requiring help with medications, N (%)*	*Missing data*	3 (2%)	-
	Yes	22 (14%)	20 (67%)
	No	135 (84%)	10 (33%)
Use of injectable medications, N (%)	*Missing data*	4 (3%)	
	Yes	5 (3%)	
	No	151 (94%)	
Medication management, N (%)	Dosette or pill box	61 (32%)	
	Medication timers	11 (5%)	
	Phone reminders	61 (31%)	
	I have someone who helps me	21 (11%)	
	I do not need reminders	41 (21%)	
Prescription management, N (%)	*Missing data*	5 (3%)	-
	PwP collects own prescriptions	107 (67%)	6 (20%)
	Someone else/caregiver collects prescriptions	18 (11%)	14 (47%)
	Prescriptions are delivered	23 (14%)	8 (27%)
	Other	7 (4%)	2 (7%)

*IQR; interquartile range, *Caregiver reported regarding the person with PD they care for*

5.3.1.3.2 Information Provision and Health Literacy

Many participants reported that it was 'Very Easy' or 'Easy' getting information about PD, although a proportion reported that it was 'Difficult' or 'Very Difficult' getting information about PD. Nearly one-third of participants reported that they did not have enough information and would like to know more. Some reported that they did not have enough information but chose not to know more. Both PwP and caregivers reported obtaining information about PD from various sources, with PD specialists, PD nurse specialists, and Parkinson's UK websites most reported (see Table 27, page 214).

Table 27: Self-reported Information Provision and Health Literacy

Variables		PwP	Caregivers
Level of difficulty getting information about PD, N (%)	*Missing data*	1 (1%)	1 (3%)
	Very Easy	29 (18%)	5 (17%)
	Easy	66 (41%)	12 (40%)
	Neither easy nor difficult	50 (31%)	10 (33%)
	Difficult	12 (8%)	1 (3%)
	Very Difficult	2 (1%)	1 (3%)
Perceived level of information about PD, N (%)	*Missing data*	1 (1%)	1 (3%)
	No, I would like to know more	53 (33%)	8 (27%)
	No, but choose not to know more	13 (9%)	6 (20%)
	Yes, enough information	87 (54%)	14 (47%)
	Yes, but I feel that I have too much information	5 (3%)	1 (3%)
Sources of information, N (%)	GP	14 (9%)	2 (7%)
	PD specialist	93 (58%)	16 (55%)
	PD nurse specialist	93 (58%)	19 (66%)
	Parkinson's UK website	116 (73%)	18 (62%)
	Parkinson's UK support group	38 (24%)	11 (38%)
	Online search	90 (56%)	10 (35%)
	From other PwP	48 (30%)	11 (38%)
	From other caregivers of PwP	5 (3%)	6 (21%)
	Prefer not to search for information	5 (3%)	2 (7%)
Health literacy, N (%)	*Missing data*	1 (1%)	1 (3%)
	Limited	17 (11%)	3 (10%)
	Not Limited	142 (88%)	26 (87%)

GP; General Practitioner

5.3.1.3.3 Healthcare Service Access and Use

A majority of participants had a named PD nurse specialist, although a proportion reported that it was either 'Difficult' or 'Very Difficult' to get in touch with them when needed. There was a median of 4 (IQR 2-8; range 0-151) total number of contacts with healthcare services reported by PwP, and a median of 6 (IQR 2-6; range 1-81) total number of contacts for the person with PD as reported by caregivers over the last 12 months for PD. The number of contact with various healthcare professionals can be seen in Table 28 (page 215).

Table 28: Self-reported Healthcare Service Access and Use

Variables		PwP	Caregivers
Named PD nurse specialist, N (%)	*Missing data =*	-	1 (3%)
	Yes	117 (73%)	19 (63%)
	No	35 (22%)	7 (24%)
	Not sure	8 (5%)	3 (10%)
Access to PD nurse specialist, N (%)	*Missing data =*	3 (2%)	3 (10%)
	Very Easy	27 (17%)	4 (13%)
	Easy	34 (21%)	4 (13%)
	Neither easy nor difficult	33 (21%)	4 (13%)
	Difficult	21 (13%)	6 (20%)
	Very Difficult	12 (7%)	4 (13%)
	Not needed to get in touch	30 (19%)	5 (17%)
Median total number of contacts with healthcare services *for PD* in the last 12 months, (IQR)*		4 (2-8)	6 (2-6)
Median number of contacts with healthcare services *for PD* in the last 12 months, (IQR)*	PD specialist doctors	1 (1-2)	2 (1-2)
	PD nurse specialist	1 (1-2)	1 (0-2)
	Physiotherapist	0 (0-0)	0 (0-3)
	Occupational therapist	0 (0-0)	0 (0-0)
	Speech and language therapist	0 (0-0)	0 (0-0)
	Dietician	0 (0-0)	0 (0-0)
	Older People Mental Health team	0 (0-0)	0 (0-0)
	GP	0 (0-1)	0 (0-2)
Median number of contacts with GP for issues *other than PD* in the last 12 months, (IQR)*		1 (0-2)	1 (1-3)
Median number of hospital attendances in an emergency the last 12 months (IQR)*		0 (0-0)	0 (0-1)
Median number of paramedics attendance in the last 12 months (IQR)*		0 (0-0)	0.5 (0.5-2)

*GP; General Practitioner, IQR; Interquartile range, *Caregiver reported regarding the person with PD they care for*

5.3.1.3.4 Access to Car and Technology

The majority of participants reported that they were able to drive their own car and were able to access and use technology without help (see Table 29, page 216).

Table 29: Self-reported Access to Car and Technology

Variables		PwP	Caregivers
Access to car, N (%)	Able to drive own car	123 (77%)	26 (87%)
	Able to travel in someone else's car	12 (8%)	3 (10%)
	Little or no access to car	2 (1%)	1 (3%)
	No longer drive due to PD	23 (14%)	
Access to technology, N (%)	Able to access and use technology without help	146 (91%)	25 (83%)
	Able to access but need help to use technology	14 (9%)	3 (10%)
	Little or no access to technology	-	2 (7%)

5.3.2 Treatment Burden Levels in PwP and Caregivers

Using the MTBQ, over one-fifth of PwP (N=34) and half of the caregivers (N=15) reported high treatment burden. Medium burden was reported by 53 of PwP and three caregivers. Low burden was reported by 48 PwP and six caregivers. Twenty-five PwP and three caregivers reported no burden. The proportions of PwP and caregivers with no, low, medium, and high treatment burden levels are summarised in Figure 26.

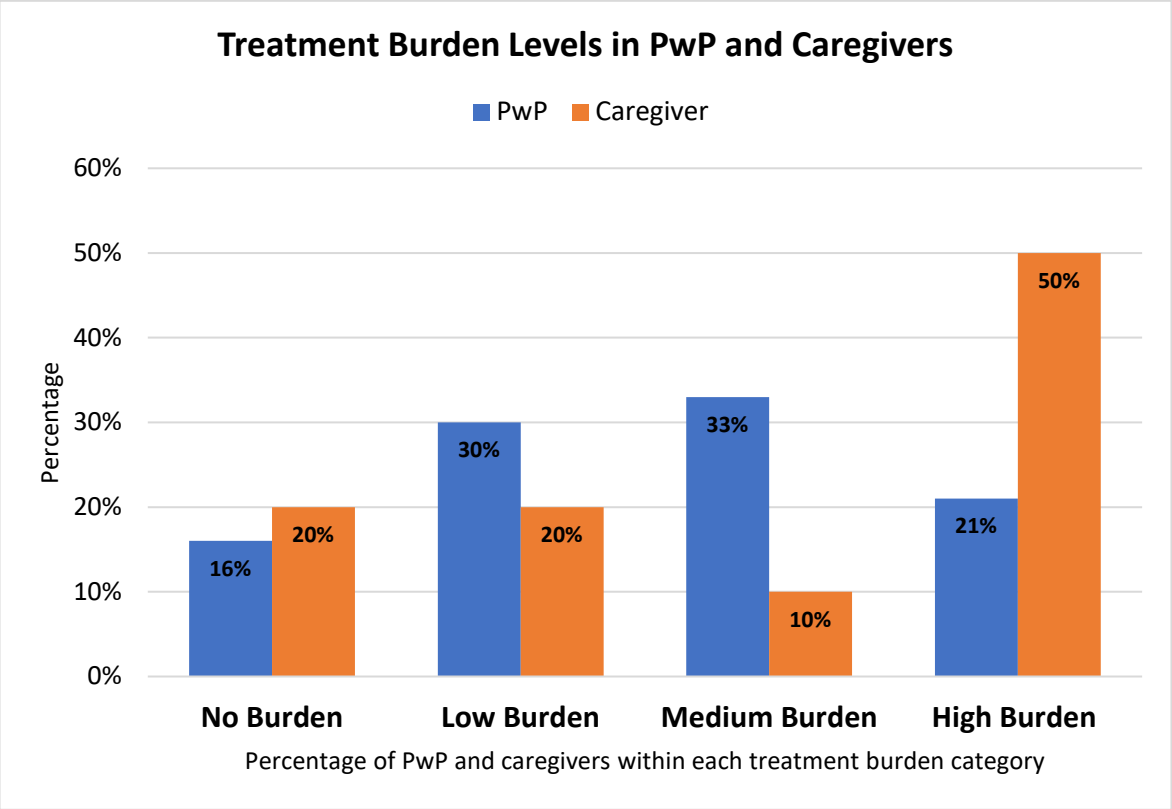


Figure 26: Treatment Burden Levels in People with Parkinson's and Caregivers

5.3.2.1 Comparison between No/Low and Medium/High Burden

5.3.2.1.1 Comparison between PwP Treatment Burden Levels

PwP who had medium/high burden were less likely to be employed, had more severe PD, higher PD NMSQuest scores, were more likely to have frailty, and had a higher frequency of medications compared to PwP with no/low burden. The median length of PD diagnosis and number of medications reported were the same between both groups. Comparison of participant characteristics between PwP with no/low and medium/high burden are summarised in Table 30.

Table 30: Comparison between treatment burden levels of People with Parkinson's

Variables		No/Low Burden (N=73)	Medium/High Burden (N=87)	P value‡
Mean age (SD), years		67.9 (7.5)	67.3 (8.7)	0.30*
Gender, N (%)	Male	30 (41%)	46 (53%)	0.14
	Female	43 (59%)	41 (47%)	
Marital status, N (%)	Single (never married or in a civil partnership)	4 (6%)	7 (8%)	0.94‡‡
	Married or in a civil partnership	58 (80%)	68 (78%)	
	Divorced or dissolved civil partnership	7 (10%)	8 (9%)	
	Widowed	3 (4%)	4 (5%)	
Living situation, N (%)	Alone	8 (11%)	13 (15%)	0.25
	With spouse/partner or family member	64 (89%)	74 (85%)	
Living property, N (%)	Own property	68 (93%)	72 (83%)	0.06‡‡
	Rented property	5 (7%)	10 (12%)	
	Relative's Home	0	3 (3%)	
	Friend's Home	0	2 (2%)	
Living area, N (%)	Urban	12 (17%)	17 (20%)	0.91
	Suburban	29 (41%)	34 (39%)	
	Rural	30 (42%)	36 (41%)	
Employment status, N (%)	Employed	15 (21%)	10 (12%)	**0.03‡‡**
	Unemployed	1 (1%)	8 (9%)	
	Retired	57 (78%)	69 (79%)	
	Degree level or above	36 (49%)	55 (64%)	0.13
	A level or equivalent	16 (22%)	19 (22%)	

Highest education level, N (%)	GCSE level or equivalent	15 (21%)	8 (9%)	
	No qualification	6 (8%)	4 (5%)	
Median length of PD diagnosis, years (IQR)		5 (2.6-7.0)	5 (3-10)	0.11†
PD severity (H&Y stage), N (%)	Mean (SD)	1.7 (0.9)	2.3 (1.1)	**<0.001**
	Stage 1	45 (61%)	31 (35%)	
	Stage 2	10 (14%)	10 (12%)	
	Stage 3	16 (22%)	39 (45%)	
	Stage 4	2 (3%)	6 (7%)	
	Stage 5	0	1 (1%)	
Median PD NMS Questionnaire score (IQR)		8 (5-12)	11 (8-14)	**<0.001†**
Median number of other long-term conditions, (IQR)		1 (1-2)	2 (1-3)	0.06†
Frailty, N (%)	Yes	23 (32%)	51 (59%)	**<0.001**
	No	50 (68%)	36 (41%)	
Quality of life (SF12v2)	Mean PCS (SD)	44.4 (9.9)	44.0 (10.6)	0.41*
	Mean MCS (SD)	48.0 (8.9)	46.6 (10.4)	0.19*
Median number of medications (IQR)		4 (2-7)	4 (2-8)	0.31†
Median frequency of medications (IQR)		4 (3-5)	5 (4-5)	**<0.001†**
Median total number of healthcare service use for PD in the last 12 months (IQR)		3 (2-6)	4 (2-8)	0.10†
Health literacy, N (%)	Not Limited	68 (94%)	74 (85%)	0.06
	Limited	4 (6%)	13 (15%)	
Access to Car, N (%)	Able to drive own car	62 (85%)	61 (70%)	0.08ǂǂ
	Able to travel in someone else's car	3 (4%)	9 (10%)	
	Little or no access to car	0	2 (3%)	
	No longer drive due to Parkinson's	8 (11%)	15 (17%)	
Access to Technology, N (%)	Able to access and use technology without help	67 (92%)	79 (91%)	0.83
	Able to access but need help to use technology	6 (8%)	8 (9%)	

*ǂChi-square test unless otherwise stated; ǂǂLikelihood ratio; *Independent t-test; †Mann-Whitney U test; H&Y; Hoehn and Yahr, IQR, Interquartile Range; NMS; Non-Motor Symptoms, SD; standard Deviation; SF12v2, Medical Outcomes Study Short Form version 2*

5.3.2.1.2 MTBQ Responses for PwP

Figure 27 shows the percentage of PwP who scored more than one point (responses a little difficult to extremely difficult) on each of the MTBQ items. Making recommended lifestyle changes was most difficult, followed by remembering how and when to take medication, obtaining clear and up-to-date information about their condition, arranging appointments with health professionals, and seeing lots of different health professionals.

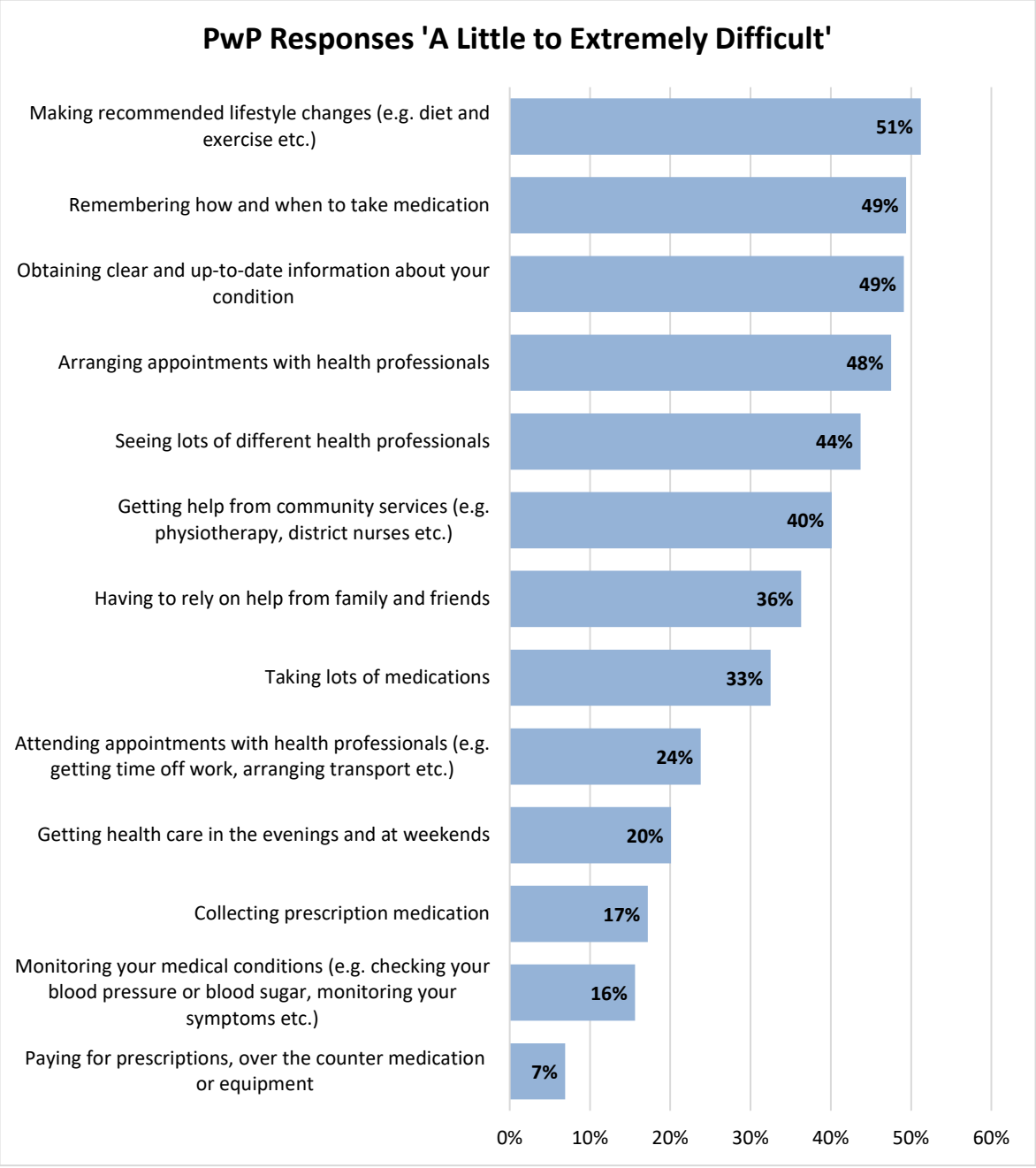


Figure 27: People with Parkinson's who responded 'a little to extremely difficult' on the Multimorbidity Treatment Burden Questionnaire

A comparison between PwP with no/low and medium/high burden who reported difficulty (responses a little to extremely difficult) and scored at least one point on each of the MTBQ items are shown in Figure 28 (page 221). PwP with medium/high burden reported that obtaining up-to-date information and making recommended lifestyle changes were most difficult. In comparison, PwP with no/low burden reported that remembering how and when to take medication was most difficult.

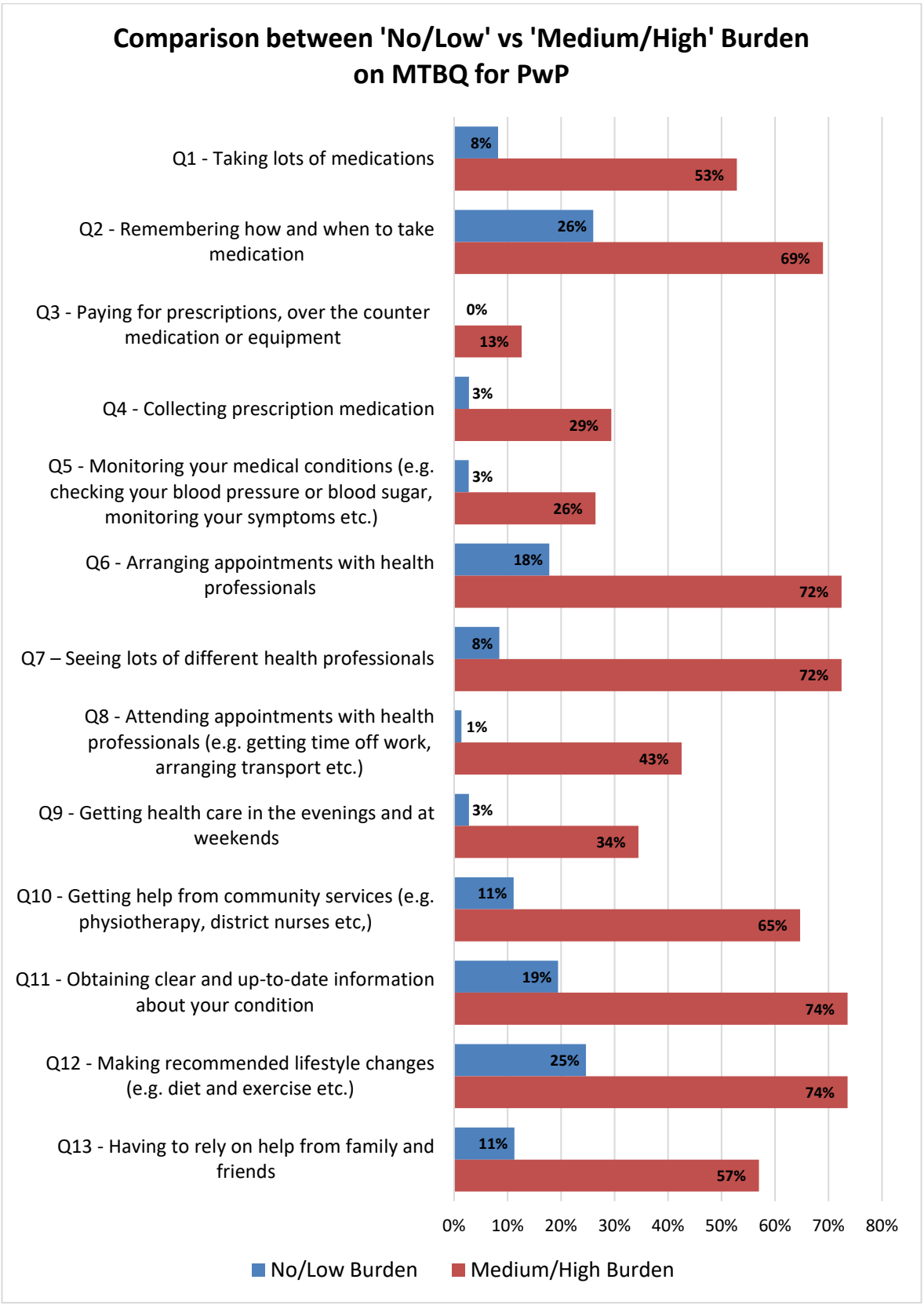


Figure 28: Comparison between No/Low vs Medium/High Burden on Multimorbidity Treatment Burden Questionnaire for People with Parkinson's

5.3.2.1.3 Comparison between caregivers

Caregivers who reported medium/high burden were younger, predominantly female, more likely to care for someone with PD H&Y stages 4-5, more likely to report memory issues in the person with PD they cared for, had lower mean MCS and PCS scores, and higher median ZBI-12 scores compared to caregivers with no/low burden. A few caregivers with medium/high burden were employed. Comparison of participant characteristics between caregivers with no/low and medium/high burden are summarised in Table 31.

Table 31: Comparison between caregiver treatment burden levels

Variables		No/Low Burden (N=12)	Medium/High Burden (N=18)	P value‡
Mean age (SD), years		71.4 (6.1)	66.5 (10.1)	0.07*
Gender, N (%)	Male	6 (50%)	2 (11%)	**0.03**
	Female	6 (50%)	16 (89%)	
Marital status, N (%)	Single (never married or in a civil partnership)	0	1 (6%)	0.34ǂǂ
	Married or in a civil partnership	12 (100%)	16 (89%)	
	Widowed	0	1 (6%)	
Living situation, N (%)	Alone	0	1 (6%)	1.00
	With spouse/partner or family member	12 (100%)	17 (94%)	
Living property, N (%)	Own property	12 (100%)	17 (94%)	1.00ǂ
	Relative's Home	0	1 (6%)	
Living area, N (%)	Urban	4 (33%)	4 (22%)	0.80ǂǂ
	Suburban	5 (42%)	9 (50%)	
	Rural	3 (25%)	5 (28%)	
Employment status, N (%)	Employed	0	3 (17%)	0.06ǂǂ
	Unemployed	0	2 (11%)	
	Retired	12 (100%)	13 (72%)	
Highest education level, N (%)	Degree level or above	1 (9%)	7 (39%)	0.06ǂǂ
	A level or equivalent	3 (27%)	7 (39%)	
	GCSE level or equivalent	6 (55%)	2 (11%)	
	No qualification	1 (9%)	2 (11%)	
Relationship to PwP	Spouse/Partner	12 (100%)	17 (94%)	1.00
	Family	0	1 (6%)	

Median length of PD diagnosis, years (IQR)		9 (3-15)	10 (7.75-14)	0.55†
PD severity (H&Y stage), N (%)	Mean (SD)	2.6 (1.6)	3.3 (1.3)	0.31*
	Stage 1	4 (36%)	3 (17%)	
	Stage 2	1 (9%)	0	
	Stage 3	3 (27%)	6 (33%)	
	Stage 4	1 (9%)	6 (33%)	
	Stage 5	2 (18%)	3 (17%)	
Caregiver reported presence of symptoms in PwP, N (%)	Mood	8 (67%)	14 (78%)	0.68
	Memory	6 (50%)	16 (89%)	**0.034**
	Hallucinations	5 (42%)	10 (59%)	0.36
Median PwP number of long-term conditions other than PD, (IQR)		2 (2-4.75)	2 (2-3.5)	0.87†
Median caregiver number of long-term conditions, (IQR)		2 (1-4)	2 (1-3)	0.79†
Frailty, N (%)	Yes	1 (8%)	3 (17%)	0.63
	No	11 (92%)	15 (83%)	
Quality of life (SF12v2)	Mean PCS (SD)	53.1 (6.6)	47.4 (13.3)	0.07*
	Mean MCS (SD)	50.2 (10.0)	39.9 (8.8)	**0.004***
Median ZBI-12 score (IQR)		10 (3.25-13.75)	23 (17.5-29)	**<0.001**†
Median number of medications for PwP (IQR)		5.5 (3-10)	6 (4.75-8.25)	0.76†
Median total number of healthcare service use for PD in the last 12 months (IQR)		4.5 (2-7.75)	6.5 (2-11.5)	0.39†
Health literacy, N (%)	Not Limited	11 (100%)	15 (83%)	0.27
	Limited	0	3 (17%)	
Access to Car, N (%)	Able to drive own car	12 (100%)	14 (78%)	0.11ǂǂ
	Able to travel in someone else's car	0	3 (17%)	
	Little or no access to car	0	1 (6%)	
Access to Technology, N (%)	Able to access and use technology without help	10 (83%)	15 (83%)	**0.035ǂǂ**
	Able to access but need help to use technology	0	3 (17%)	
	Little or no access to technology	2 (17%)	0	

ǂFisher's exact test unless otherwise stated; ǂǂLikelihood ratio; **Independent t-test; †Mann-Whitney U test; H&Y; Hoehn and Yahr, IQR; Interquartile Range; NMS, Non-Motor Symptoms; SD, Standard Deviation; SF12v2, Medical Outcomes Study Short Form version 2; ZBI, Zarit Burden Interview*

5.3.2.1.4 MTBQ Responses for Caregivers

Figure 29 shows the percentage of caregivers who reported difficulty (responses a little to extremely difficult) on each of the MTBQ items. Caregivers reported that adjusting their lifestyle to look after the person they cared for was most difficult, followed by making recommended changes to their lifestyle, seeing lots of different health professionals, arranging appointments with health professionals, and getting help from community services.

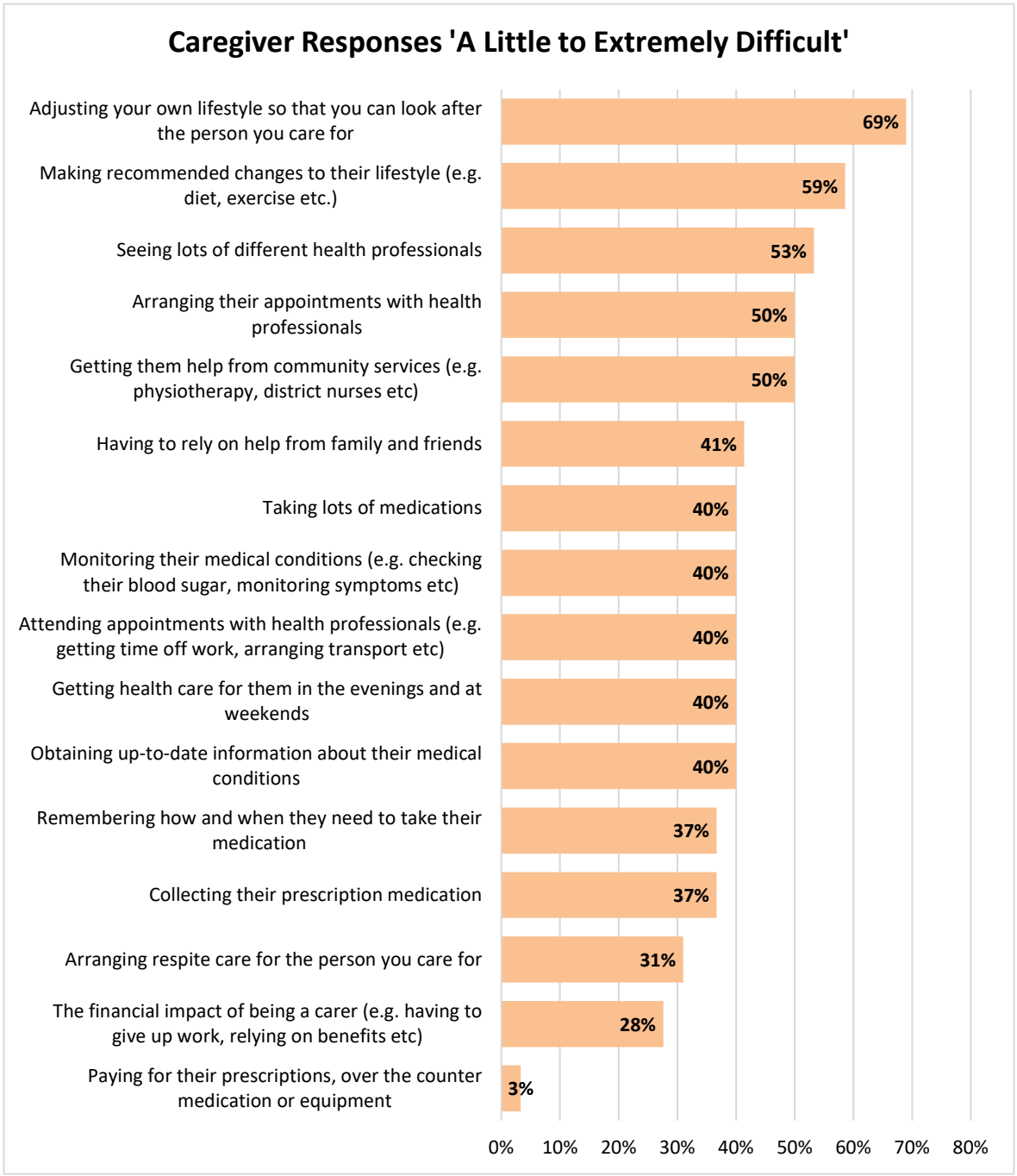


Figure 29: Caregivers who responded 'a little to extremely difficult' on the Multimorbidity Treatment Burden Questionnaire

A comparison between caregivers with no/low and medium/high burden who reported difficulty (responses a little to extremely difficult) on each of the MTBQ items are shown in Figure 30 (page 226). Adjusting their own lifestyle to look after the person they cared for was most difficult for caregivers with both no/low and medium/high burden. None of the caregivers with no/low burden reported that they had any difficulty with eight items on the MTBQ. In comparison, caregivers with medium/high burden reported fairly global difficulty across most items on the MTBQ.

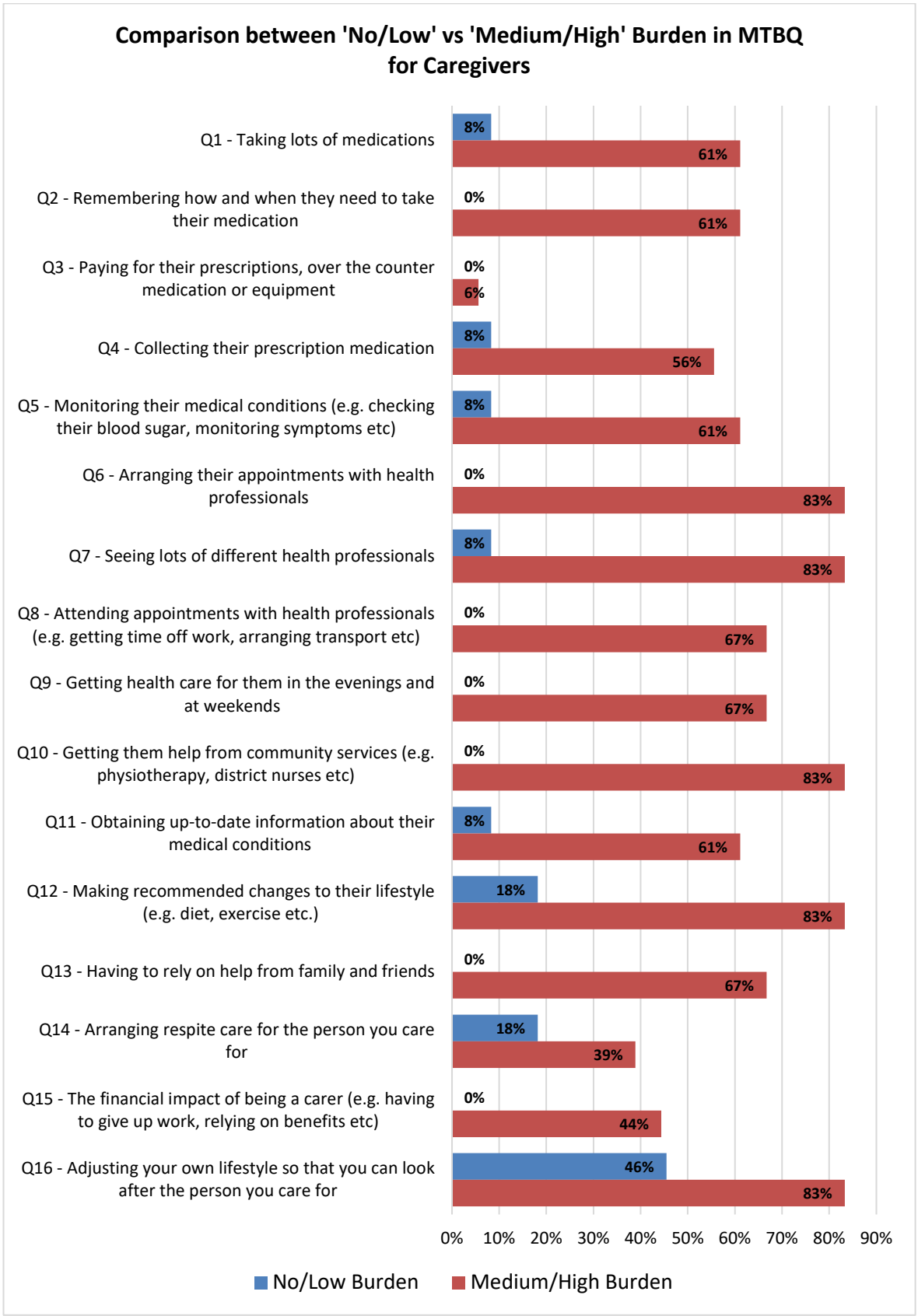


Figure 30: Comparison between No/Low vs Medium/High Burden on Multimorbidity Treatment Burden Questionnaire for Caregivers

5.3.2.1.5 Difficulty on MTBQ and Aspects of Treatment Burden and Capacity

The associations between items on the MTBQ and measured aspects of treatment burden and capacity (prescriptions and medications, information provision, and healthcare service use) are reported in this section.

5.3.2.1.5.1 Difficulty with medications and prescriptions

The association between 'difficult' responses on the MTBQ items "Taking lots of medications", "Remembering how and when to take medication" and "Collecting prescription medications" and measured treatment burden aspects (number of medications, frequency of medications, prescription management) are seen in Table 32. For PwP, the number of medications were significantly associated with difficulty in taking lots of medications and remembering how and when to take medications. There were no significant associations with the frequency of medications. PwP who required someone to collect their prescription for them had higher odds ratios of reporting difficulty with collecting prescription medication.

Table 32: Univariable associations with difficulty managing medications and prescriptions

Treatment Burden Aspects		PwP				Caregivers			
		OR	95% CI		p value	OR	95% CI		p value
Difficulty taking lots of medications									
Number of medications for the person with PD		1.22	1.10	1.35	**<0.001**	0.91	0.74	1.13	0.39
Frequency of medications for the person with PD		1.14	0.99	1.32	0.08				
Difficulty remembering how and when to take medications									
Number of medications for the person with PD		1.18	1.07	1.31	**0.001**	0.90	0.72	1.12	0.34
Frequency of medications for the person with PD		1.11	0.96	1.28	0.17				
Difficulty collecting prescription medication									
Prescription management (vs able to collect own prescriptions)	Someone else or caregiver collects prescriptions	12.18	3.97	37.41	**<0.001**	6.67	0.61	73.03	0.12
	Prescriptions are delivered	1.72	0.50	5.95	0.39	0.71	0.04	14.35	0.83

CI; confidence interval, OR; odds ratio

5.3.2.1.5.2 Difficulty with information provision

Table 33 summarises the associations with respondents who reported difficulty with "Obtaining up-to-date information about your/their condition" on the MTBQ. For PwP, this was significantly associated with those who reported that they did not have enough information. Limited health literacy may potentially be associated with difficulty obtaining information, although this should be interpreted with caution due to the small sample size.

Table 33: Univariable associations with difficulty obtaining information

Treatment Burden Aspects		PwP				Caregivers			
		OR	95% CI		p value	OR	95% CI		p value
Perceived level of information *(vs Yes, I have enough information)*	No, I would like to know more	3.58	1.75	7.33	**<0.001**	11.00	1.42	85.20	0.02
	No, but I choose not to know more	7.33	1.90	28.35	**0.004**	1.83	0.22	14.3	0.58
	Yes, but I feel I have too much information	7.00	0.86	74.86	0.07				
Health literacy *(vs not limited)*	Limited	2.73	0.91	8.15	0.07	3.20	0.26	40.06	0.37

CI; confidence interval, OR; odds ratio

5.3.2.1.5.3 Difficulty with appointments

The total self-reported number of contacts with healthcare services for PD in the last 12 months were not significantly associated with difficulty "Arranging appointments with health professionals", "Seeing lots of different health professionals" and "Attending appointments with health professionals" for both PwP and caregivers (see Table 34, page 229).

Table 34: Difficulty with appointments and the total number of contacts with healthcare services for Parkinson's disease in the last 12 months

Treatment Burden Aspects	PwP				Caregivers			
	OR	95% CI		p value	OR	95% CI		p value
Difficulty arranging appointments with health professionals								
Total number of contacts to healthcare services for PD in the last 12 months	0.99	0.96	1.02	0.42	1.05	0.95	1.17	0.34
Difficulty seeing lots of different health professionals								
Total number of contacts to healthcare services for PD in the last 12 months	0.99	0.97	1.02	0.86	1.05	0.95	1.17	0.36
Difficulty attending appointments with health professionals								
Total number of contacts to healthcare services for PD in the last 12 months	1.05	0.98	1.10	0.06	1.02	0.97	1.08	0.45

CI; confidence interval, OR; odds ratio

5.3.2.1.6 Caregiver burden and treatment burden in caregivers

A comparison between caregivers with no/low burden and medium/high burden and responses to each item on the ZBI-12 (combining responses 'rarely', 'sometimes', 'quite frequently' and 'nearly always') are shown in Figure 31 (page 230). A larger proportion of caregivers with medium/high burden were more likely to report that they 'rarely to nearly always' experienced the feelings of each of the items on the ZBI-12 compared to caregivers with no/low burden. Caregivers with no/low burden were most likely to report that they felt that they should be doing more for the person with PD and that they could do a better job in caring for the person with PD. In comparison, the majority of caregivers with medium/high burden felt that they did not have enough time to themselves because of time spent with the person with PD and felt stressed between caring for the person with PD and trying to meet other responsibilities for their family or work.

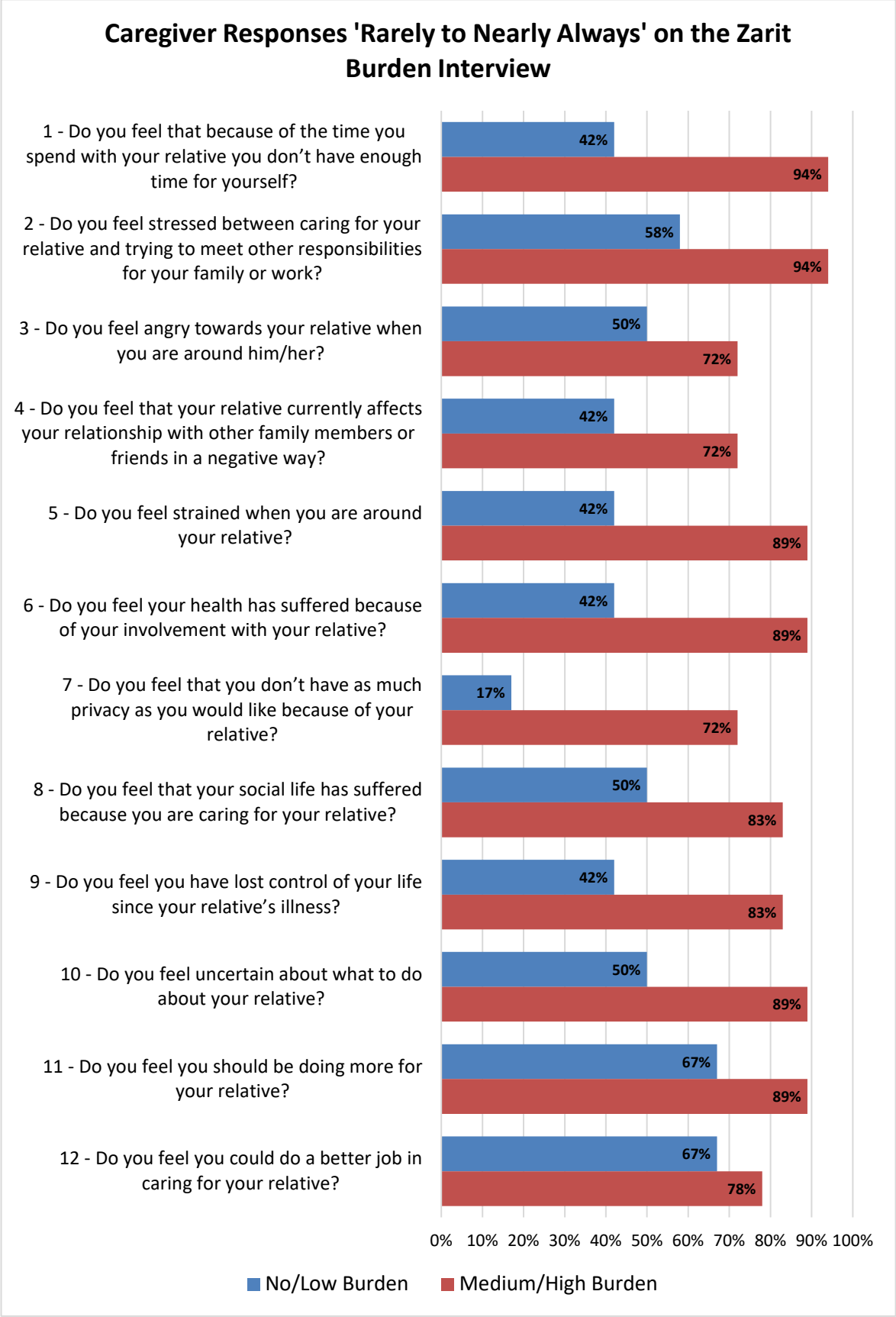


Figure 31: Responses 'Rarely to Nearly Always' on the Zarit Burden Interviews and Caregiver Treatment Burden Levels among Caregivers

5.3.3 Factors associated with Treatment Burden in PwP

Univariable analysis and multivariable binary logistic regression analysis findings are described in this section.

5.3.3.1 Univariable Analysis

PwP who reported needing help on a regular basis, had higher H&Y stages, higher NMSQuest score, frailty, and took medications more than three times a day had significantly higher odds ratios of medium/high burden. PwP who were living in rented or family/friends' property, had longer years with PD diagnosis, higher number of medications, limited health literacy and lacked the ability to drive and use a car had increased odds ratios of medium/high burden, with $p \leq 0.25$. Those who were employed had lower odds ratios of medium/high treatment burden levels compared to those who were unemployed or retired. The findings are summarised in Table 35, with the variables highlighted in green included in the multivariable logistic regression analysis.

Table 35: Univariable Analysis of Variables Associated with Treatment Burden in People with Parkinson's

Variables		OR	95% CI		p value
Age *(continuous variable)*		0.99	0.95	1.03	0.60
Gender *(vs female)*		1.61	0.86	3.01	0.14
Marital status (vs married/civil partnership)	Single or divorced/dissolved civil partnership or widowed	1.16	0.53	2.51	0.71
Living situation *(vs alone)*	With spouse/ partner/ family or friends	0.71	0.28	1.83	0.48
Living property *(vs own)*	Rented or in family/ friends' property	2.83	0.98	8.22	0.06
Living area *(vs urban)*	Suburban	0.83	0.34	2.02	0.91
	Rural	0.85	0.35	2.05	
Employment *(vs unemployed or retired)*	Employed	0.50	0.21	1.20	0.12
Needing help on a regular basis *(vs No)*		2.81	1.32	6.01	**0.008**
Length of PD diagnosis *(years)*		1.05	0.98	1.13	0.19
PD severity (H&Y stage) *(vs stage 1)*	Stage 2	1.45	0.54	3.90	**0.004**
	Stage 3	3.54	1.69	7.42	
	Stage 4 and 5	5.08	0.99	26.11	

PD NMSQuest score		1.13	1.06	1.21	**<0.001**
Other long-term conditions *(vs 0-1)*	≥2 long-term conditions	1.55	0.83	2.91	0.17
Frailty *(vs not frail)*	Frail	3.08	1.61	5.92	**<0.001**
Quality of life *(SF12v2)*	Physical component score	1.00	0.97	1.03	0.83
	Mental component score	0.99	0.95	1.02	0.38
Number of medications *(vs 0-1)*	2	2.40	0.63	9.12	0.39
	3	1.07	0.23	4.89	
	4	3.02	0.76	12.00	
	≥5	1.94	0.60	6.50	
Frequency of medications *(vs 0-3 times a day)*	>3 times day	3.42	1.68	6.95	**<0.001**
Health literacy *(vs not limited)*	Limited	2.99	0.93	9.60	0.07
Total healthcare service use for PD in the last 12 months *(vs 0-2)*	≥3 times	1.14	0.58	2.25	0.70
Access to car *(vs able to drive and use car)*	Can regularly travel in someone else's car	3.05	0.79	11.80	0.09
	No longer drive or have little to no access to car	2.16	0.87	5.38	
Access to technology *(vs able to access and use technology regularly)*	Able to access but need help using technology	1.13	0.37	3.42	0.83

CI; confidence interval, H&Y; Hoehn and Yahr, NMSQuestion; Non-Motor Symptoms Questionnaire, OR; odds ratio, SF12v2, Medical Outcomes Study Short Form version 2; Variables highlighted in green were included in the multivariable analysis

5.3.3.2 Multivariable Analysis

Four independent multivariable logistic regression models were conducted, with results summarised in Table 36 (page 234).

Model 1: Adjusting for sociodemographic factors (age, gender, living property and employment)

Adjusting for sociodemographic factors, PwP who reported needing help on a regular basis, PD severity, PD NMSQuest scores, frailty, and frequency of medications were significantly associated with medium/high burden. PwP who reported limited health literacy and those who did not drive or have regular use of own car had higher odds of medium/high burden. The number of other

LTCs and number of medications were not significantly associated with higher odds of medium/high burden.

Model 2: Adjusting for sociodemographic factors and other health characteristics (self-reported number of other LTCs and frailty)

Adjusting for sociodemographic factors and other health characteristics, PD NMSQuest scores and frequency of medications were significantly associated with medium/high burden. Higher H&Y limited health literacy, and not being able to drive or access their own car had increased odds ratios of medium/high burden.

Model 3: Adjusting sociodemographic factors and PD characteristics (length of PD diagnosis, PD severity and PD NMSQuest score)

Adjusting for sociodemographic and PD health characteristics, frailty, and frequency of medications were significantly associated with medium/high burden. Limited health literacy and poor car access were associated with increased odds ratios of medium/high burden outcomes. The number of other LTCs and number of medications were not significantly associated with medium/high burden.

Model 4: Adjusting for non-modifiable variables (age, gender, living property, employment needing help on a regular basis, length of PD diagnosis, PD severity, number of other LTCs)

Adjusting for non-modifiable variables, PD NMSQuest scores and frequency of medications were significantly associated with medium/high burden. Frailty, limited health literacy, and poor car access had higher odds of association with medium/high burden, although this was not statistically significant in this small sample.

Table 36: Odds ratios of medium/high burden with multivariable logistic regression models

Variables		Model 1*			Model 2**			Model 3***			Model 4****		
		aOR	95% CI	P value	aOR	95% CI	P value	aOR	95% CI	P value	aOR	95% CI	P value
Needing help on a regular basis *(vs No)*		2.92	1.31 – 6.50	**0.009**	1.76	0.64 – 4.79	0.27	1.62	0.64 – 4.08	0.31			
Length of PD diagnosis *(years)*		1.05	0.97 – 1.14	0.22	1.03	0.95 – 1.12	0.44						
PD severity (H&Y stage) *(vs stage 1)*	Stage 2	1.56	0.56 – 4.36	**0.01**	1.73	0.61 – 4.92	0.06						
	Stage 3	3.60	1.63 – 7.94		3.02	1.33 – 6.87							
	Stage 4 and 5	3.93	0.72 – 21.48		3.21	0.53 – 19.40							
PD NMSQuest score		1.12	1.04 – 1.21	**0.002**	1.10	1.02 – 1.12	**0.011**				1.09	1.01 – 1.18	**0.03**
Other long-term conditions *(vs 0-1)*	≥2 long-term conditions	1.48	0.75 – 2.93	0.26				1.40	0.64 – 3.04	0.40			
Frailty *(vs not frail)*	Frail	3.12	1.46 – 6.67	**0.003**				2.45	1.03 – 5.85	**0.04**	2.33	0.84 – 6.51	0.11
Number of medications *(vs 0-1)*	2	1.50	0.36 – 6.26	0.40	1.39	0.32 – 6.08	0.22	1.23	0.26 – 5.90	0.26	1.31	0.29 – 5.99	0.19
	3	0.63	0.12 – 3.31		0.50	0.09 – 2.76		0.34	0.06 – 2.05		0.39	0.07 – 2.20	
	4	2.49	0.57 – 10.82		2.36	0.51 – 10.95		1.63	0.31 – 8.52		1.56	0.32 – 8.01	
	≥5	1.43	0.39 – 5.28		0.78	0.19 – 3.25		0.69	0.15 – 3.10		0.54	0.12 – 2.52	

Frequency of medications *(vs 0-3 times a day)*	>3 times day	3.01	1.44 – 6.30	**0.003**	2.75	1.29 – 5.86	**0.009**	2.97	1.28 – 6.87	**0.01**	2.91	1.27 – 6.66	**0.01**
Health literacy *(vs not limited)*	Limited	3.26	0.98 – 10.83	0.054	2.37	0.68 – 8.24	0.18	2.14	0.55 – 8.27	0.27	2.58	0.69 – 9.59	0.16
Access to car *(vs able to drive and use car)*	Can regularly travel in someone else's car	4.58	1.07 – 19.69	0.056	4.38	0.96 – 20.04	0.14	4.16	0.85 – 20.46	0.22	4.35	0.87 – 21.73	0.20
	No longer drive or have little to no access to car	2.12	0.81 – 5.59		1.53	0.55 – 4.24		1.16	0.37 – 3.68		1.16	0.37 – 3.68	

aOR; Adjusted Odds Ratio, CI; Confidence Interval, H&Y; Hoehn and Yahr, NMSQuest; Non-Motor Symptom Questionnaire
**Model 1 adjusted for age, gender, living property and employment.*
***Model 2 adjusted for age, gender, living property, employment, number of long-term conditions and frailty.*
****Model 3 adjusted for age, gender, living property, employment, length of PD diagnosis, PD severity and PD NMSQuest score.*
*****Model 4 adjusted for age, gender, living property, employment, needing help on a regular basis, length of PD diagnosis, PD severity and number of long-term conditions.*

5.3.4 Evaluation of the single-item treatment burden measure

The sensitivity, specificity, PPV, NPV, positive likelihood ratio, ROC and AUC evaluating the single-item burden measure against those with medium/high burden and those with high burden are presented below. Overall, the single-item treatment burden measure had higher specificity then sensitivity and showed moderate performance for both reference levels.

5.3.4.1 Using Medium/High Burden as reference

The usefulness of the single-item treatment burden measure using MTBQ categories medium/high burden as a reference was calculated (see Table 37): sensitivity = 33.7%, specificity = 93.2%, PPV = 85.3%, NPV = 54.4% and positive likelihood ratio = 4.96.

Table 37: Evaluation of the single-item treatment burden measure using 'medium/high' burden as a reference

		MTBQ categories		Total
		Medium/High Burden	No /Low Burden	
Single-item treatment burden measure	**Yes**	29	5	34
	No	57	68	125
	Total	86	73	159

A ROC was plotted (see Figure 32, page 237) with AUC = 0.645, indicating moderate performance of the single-item treatment burden measure in identifying PwP with medium or high treatment burden levels.

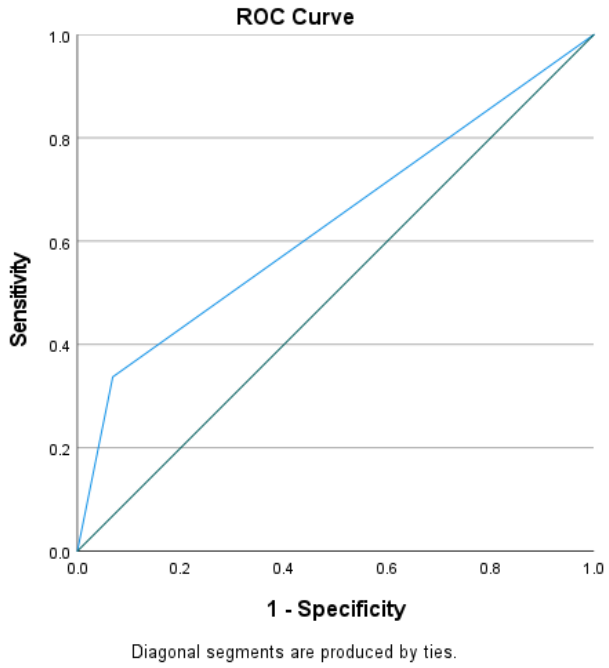


Figure 32: Receiver Operating Curve for the Single-item Treatment Burden Measure using medium/high burden as reference

5.3.4.2 Using High Burden as a reference

The usefulness of the single-item treatment burden measure using MTBQ outcome category high burden as a reference was calculated (see Table 38): sensitivity = 51.5%, specificity = 86.5%, PPV = 50%, NPV = 87.2%% and positive likelihood ratio = 3.81.

Table 38: Evaluation of the single-item treatment burden measure using 'high' burden as a reference

		MTBQ categories		Total
		High Burden	No /Low/Medium Burden	
Single-item treatment burden measure	**Yes**	17	17	34
	No	16	109	125
	Total	33	126	159

A ROC was plotted (see Figure 33) with AUC = 0.690, similarly indicating moderate performance of the single-item treatment burden measure in identifying PwP with high treatment burden levels.

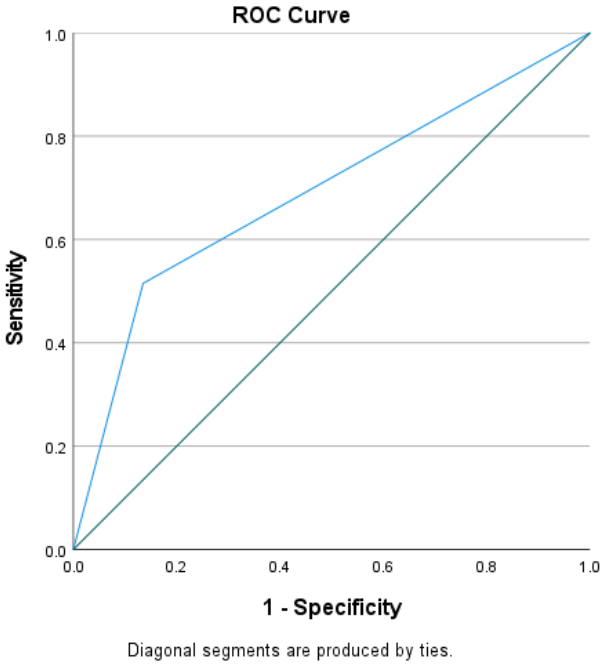


Figure 33: Receiver Operating Curve for the Single-item Treatment Burden Measure using high burden as reference

5.4 Discussion

In this national survey of 160 PwP and 30 caregivers, more than 50% of participants reported medium or high treatment burden levels. For PwP, the main contributing aspects of treatment burden were making lifestyle changes, remembering how and when to take medications, and obtaining clear and up-to-date information about PD. For caregivers, adjusting their own lifestyle for the person with PD, helping the person with PD make lifestyle changes, and getting help from community services were the most difficult aspects of treatment burden. Arranging appointments and seeing lots of health professionals also contributed to both PwP and caregiver treatment burden.

Nearly half of PwP had frailty and multimorbidity, with hypertension and osteoarthritis the most common self-reported LTC other than PD. Medium/high treatment burden was independently associated with PwP who were frail, had a higher number of NMS, and took medications more than three times a day in the multivariable logistic regression models after adjusting for sociodemographic factors, health, and PD characteristics. Adjusting for sociodemographic data,

PwP who reported requiring help on a regular basis and those with more severe PD (H&Y stages) were also associated with medium/high treatment burden. There did not appear to be an association between multimorbidity or the number of medications with treatment burden for PwP.

Most caregivers themselves reported living with one or more LTC. Compared to PwP, caregivers in this survey cared for someone with PD who had more severe PD and had been diagnosed with PD for longer. Being a female caregiver, caring for someone with PD who experienced memory issues, and caregivers with lower mental health functioning may be associated with medium/high caregiver treatment burden, although the small sample size of caregiver respondents limited further evaluation. Interestingly, the majority of caregivers reported helping the person with PD with their medications, whilst only a small proportion of PwP reported needing help with their medications. This may be due to the worsening severity of PD that affects the person with PD's ability to manage their medications, relying instead on their caregivers. Caregiver burden was significantly higher in caregivers with medium/high treatment burden. This perhaps highlights the impact of treatment burden on caregivers of PwP and the potential interlink between these separate concepts.

The single-item treatment burden measure showed moderate performance in PD and may help identify PwP who had no or low treatment burden. However, this study suggests that there may be better ways to identify PwP and caregivers with high treatment burden. The single-item treatment burden measure does not include key aspects of treatment burden and further development is needed, including consideration of the development of a PD-specific version.

5.4.1 How do the survey findings compare with the systematic review and interview findings?

The survey has highlighted important findings that were not previously reported in the systematic review and interviews, including the extent and associations of overall treatment burden levels in PwP and caregivers using the MTBQ. The association of PD severity and symptoms with treatment burden levels reported in the systematic reviews and interviews were iterated in this survey. The overlapping themes of treatment burden and capacity following the integration of findings from the Work Package 1 and 2 of this study (systematic review and interviews) were previously described in Section 4.4.1 (page 187) and summarised in Table 18 (page 189). There were four overlapping themes which were: 1) attending multiple appointments and accessing healthcare professionals, 2) getting satisfactory levels of information related to PD, 3) managing prescriptions

and medications, and 4) personal life adaptations. Table 39 (page 241) builds on these findings and summarises the novel findings from the survey as well as the interlinked aspects of treatment burden and capacity from the survey compared to the findings from the previous Work Packages.

Table 39: Novel findings and interlinked issues of treatment burden from the surveys compared to the overlapping themes from the systematic review and interviews

Overlapping themes from systematic review and interviews	Novel findings of treatment burden and capacity in PwP and caregivers from the surveys	Interlinked treatment burden items on MTBQ with 'Difficult' responses and other measured aspects of treatment burden and capacity from surveys	
		PwP	Caregivers
Theme 1: **Attending multiple appointments and accessing healthcare professionals**	• Getting help from community services and healthcare in the evenings at the weekends were other issues that contributed to the treatment burden for PwP and caregivers. These were not reported in the systematic review and interviews. • The total number of contacts with healthcare services for their PD did not contribute to the treatment burden in PwP and caregivers.	○ Arranging appointments with health professionals (48%) ○ Seeing lots of different health professionals (44%) ○ Getting help from community services (40%) ○ Attending appointments with health professionals (24%) ○ Getting healthcare in the evenings and weekends (20%) • Median total number of contacts with healthcare services for PD in the last 12 months = 4 (IQR 2-8)	○ Seeing lots of different health professionals (53%) ○ Arranging their appointments with health professionals (50%) ○ Getting them help from community services (50%) ○ Attending appointments with health professionals (40%) ○ Getting healthcare for them in the evenings and at weekends (40%) • Median total number of contacts with healthcare services for PD in the last 12 months = 6 (IQR 2-6)
Theme 2:	• The lack of information provision was more burdensome to PwP and	○ Obtaining clear and up-to-date information about your condition (49%)	○ Obtaining clear and up-to-date information about their condition (40%)

Getting satisfactory levels of information related to PD	caregivers compared to knowing too much information. • Few participants reported limited health literacy which may contribute to difficulty obtaining and understanding information related to PD.	11% reported limited health literacy **<u>Perceived levels of information:-</u>** • No, I would like to know more (34%) • No, but I choose not to know more (8%) • Yes, but I feel I have too much information (3%)	10% reported limited health literacy **<u>Perceived levels of information:-</u>** • No, I would like to know more (27%) • No, but I choose not to know more (20%) • Yes, but I feel I have too much information (3%)
Theme 3: **Managing prescriptions and medications**	• The total number of medications contributed to difficulty with taking lots of medications and remembering how and when to take medications on the MTBQ for PwP. • The frequency of medications was independently associated with medium/high treatment burden levels in PwP. • Collecting prescriptions was not a major aspect of treatment burden in the surveys compared to the interviews. However, having someone else or a caregiver to help collect prescriptions or the use of prescription delivery services may help PwP and caregivers manage this aspect of treatment burden	○ Remembering how and when to take medication (49%) ○ Taking lots of medication (33%) ○ Collecting prescription medication (17%) ○ Monitoring your medical conditions (16%) • Median number of meds = 4 (IQR 2-7) • 46% reported taking more than five medications • Median frequency of meds = 4 (IQR 3-5) • 13% reported needing help with medications **<u>Prescription management:</u>** • Able to collect own prescriptions (67%) • Someone else collects prescriptions (11%) • Prescriptions delivered (14%)	○ Taking lots of medications (40%) ○ Monitoring their medical conditions (40%) ○ Remembering how and when they need to take their medications (37%) ○ Collecting their prescription medication (37%) • Median number of meds = 6 (IQR 4-9) • 69% reported that the person with PD took more than five medications • 67% reported helping the person with PD with their medications **<u>Prescription management:</u>** • Person with PD able to collect own prescription (20%) • Person with PD has someone to collect prescription (47%) • Prescriptions delivered (7%)

Theme 4: **Personal life adaptation**	• Making recommended lifestyle changes was reported as the most difficult item for PwP and the second most difficult for caregivers in the surveys on the MTBQ. This had not been the main issue of treatment burden reported in the systematic review or interviews. • Caregivers reported adjusting their own lifestyle to look after the person with PD as most burdensome. This was not reported in the interviews and instead resonates with the impact of treatment burden described in the systematic review. • The financial aspect of treatment burden was the least burdensome for PwP and caregivers	○ Making recommended lifestyle changes (51%) ○ Having to rely on help from family and friends (36%) ○ Paying for prescriptions, over the counter medication or equipment (7%) • 77% able to drive their own car • 91% able to access and use technology without help	○ Adjusting your own lifestyle so that you can look after the person you care for (69%) ○ Making recommended changes to their lifestyle (59%) ○ Having to rely on help from family and friends (41%) ○ Arranging respite care for the person you care for (31%) ○ The financial impact of being a carer (28%) ○ Paying for their prescriptions, over the counter medication or equipment (3%) • 87% able to drive their own car • 83% able to access and use technology without help

○ *Items on the MTBQ with (%) of participants reporting difficulty with each item; IQR; interquartile range , MTBQ; Multimorbidity Treatment Burden Questionnaire*

5.4.2 How does this compare with the literature?

There were similar proportions of high treatment burden levels amongst PwP (21%) compared to other studies conducted in the UK, including the MTBQ validation study (27%) and the Dorset treatment burden survey in patients with multimorbidity (18%)(80, 113). Making recommended lifestyle changes was the most difficult aspect of treatment burden in PD, consistent with findings from the UK studies(80, 113). Compared to studies using the MTBQ in other countries, a Danish study of patients with cardiovascular disease also reported comparable proportions (20%) of high treatment burden(112). The Danish validation study of the MTBQ reported a smaller proportion (13%) of participants with high treatment burden compared to PD(235). The wide inclusion criteria of any adults in the Danish study who received treatment or took medication for one or more health conditions or adults who attended rehabilitation or regular check-ups may explain the difference in burden. In contrast, the Chinese validation study of MTBQ in older hospital patients with multimorbidity reported a larger proportion (46%) of high treatment burden compared to those with PD, although assessment of treatment burden in hospital settings may explain the greater burden(315).

Age and gender were not associated with treatment burden in PD. However, other studies have found that younger patients and female gender were more likely to report high treatment burden(80, 113, 201, 316). PD severity, NMS and higher frequency of medications were associated with treatment burden in this survey. Whilst no other studies of treatment burden in PD have been conducted, studies have reported that longer duration of PD, neuropsychiatric NMS, and complex medication regimes were associated with lower levels of medication adherence in PwP(126, 317). Identifying these factors in PD is important as high treatment burden is also associated with poor medication adherence in patients with one or more LTCs(86). PwP who reported requiring someone to help them regularly had higher odds of having medium/high burden, which aligns with findings from other studies of treatment burden in caregivers of older adults and caregivers of someone with a chronic condition(79, 318). PwP with limited health literacy had higher odds of medium/high burden, which suggest a potential association between these two aspects although only a few participants had low health literacy and the sample size was small. Other studies have reported a strong relationship and increasing odds of having high treatment burden in patients who have low health literacy levels(112, 113, 319, 320).

In this study, the number of LTCs was not associated with medium/high treatment burden in PwP. This resonates with studies that evaluated treatment burden using the PETS measure in patients

with multimorbidity and those undergoing dialysis treatment(87, 321). The PETS was previously described in Section 1.8.2 (page 57) and assesses treatment burden across nine domains and does not generate an overall treatment burden score unlike the MTBQ(87). Conversely, other studies in older adults with multimorbidity have reported positive associations between the number of LTCs and treatment burden using the MTBQ(80, 113). However, the number of other LTCs for PwP in this survey was derived from self-reported data and not medical records. Self-reported health conditions amongst community-dwelling older people have been shown to have substantial variation in agreement with general practice medical records(215). Therefore, the impact of multimorbidity on treatment burden in PwP should be evaluated further.

The association between frailty and treatment burden has not been previously explored in other studies and is thus novel in this study. However, the independent association of frailty and medium/high treatment burden in PD found in this study should be interpreted with caution. The PRISMA-7 frailty measure used in this survey consists of seven questions about age, gender, general health, activities, and social supports(218). Some of these reflect deficits in physical and functional domains of frailty which may be due to the underlying neurodegenerative process in PD. No frailty measure has been validated in PD, and it remains unclear how best to identify frailty in PD given the overlapping clinical features between the two conditions(46). However, active screening and early recognition of frailty in PD remain essential as there may be potential interventions that can improve health outcomes in these patients(34).

Caregivers with medium/high treatment burden may also experience high caregiver burden levels when supporting someone with PD. Although this association has not been specifically explored in other studies, Giovannetti et al found that caregivers of older adults with multimorbidity reported higher difficulty in completing healthcare tasks was strongly associated with higher caregiver strain and caregiver depression(123). They also reported that helping to make recommended diet changes for the person they care for was reported as most difficult by caregivers. This resonates with findings from caregivers in this study for whom supporting the person with PD with lifestyle changes was one of the main contributory aspects of treatment burden. A qualitative study exploring the treatment burden in caregivers of older adults diagnosed with diabetes and cognitive impairment or dementia described the increasing difficulty for caregivers to manage mealtimes with a restricted diet as cognitive status worsened(310). Therefore, the association between caring for someone with PD and memory issues with medium/high treatment burden reported in this survey may potentially explain the difficulties reported by caregivers with this aspect of treatment burden.

The initial single-item treatment burden measure developed by Morris et al performed moderately well in identifying high treatment burden in primary care(113). This measure was further developed in the follow-up Dorset survey and found to have higher sensitivity (92.5%) than sensitivity (56.5%) with the AUC of 0.74(120). The moderate performance of the single-item treatment burden measure in discriminating those with high treatment burden is comparable to the findings in this study. There may be a need for a simpler treatment burden screening measure in PD consisting of more than one question, yet shorter to complete compared to the full MTBQ.

5.4.3 Strengths and Limitations

A strength of this study is the novel use of the MTBQ to assess the extent and drivers of treatment burden in PwP and caregivers which has not been conducted previously. Furthermore, the survey included a wider population of PwP and caregivers across the UK with a range of sociodemographic characteristics and varying lengths of PD diagnosis and severity. Although the cross-sectional design of the survey meant that causality and directionality of associations cannot be inferred, this was not the aim of this exploratory study. This study has some limitations. Firstly, the lack of ethnic diversity and potential for selection bias with recruitment through Parkinson's UK as participants were a self-selected population who had expressed an active interest in participating in research studies, have access to technology, were able to use a computer, and may have already participated in multiple online surveys for research. This may limit the generalisability of the findings. Participant recruitment from PD clinics attempted to reduce this bias and encouraged participation from those who may not have access to technology but was still interested in participating in research studies. Secondly, all data were self-reported by participants which relies on participant recall and may have a high chance of bias. Furthermore, this survey was conducted during the COVID-19 pandemic which may have had an impact on service provision and access to healthcare services and may have influenced the treatment burden experienced by PwP and caregivers. The groupings of no/low vs medium/high treatment burden levels and responses to items on the MTBQ and ZBI-12 during data analysis may have also led to a bias with statistical analysis using alternative groupings having differing outcomes. Finally, the small number of caregiver respondents and the lack of validation of the MTBQ in caregivers are further limitations.

5.5 Conclusion

PwP and caregivers experienced treatment burden when looking after their health with PD. Making lifestyle changes was most burdensome for PwP and caregivers. PwP with worsening severity of PD, those with multiple NMS, concurrent frailty, and those with a higher frequency of medication timings may be at risk of experiencing higher treatment burden. Frailty and limited health literacy may also contribute to treatment burden. This study has identified the potentially modifiable factors to improve treatment burden and prevent poor health outcomes in PD. For example, providing support to PwP and caregivers with enacting recommended lifestyle changes by encouraging self-management in PD could reduce the treatment burden. However, this should be considered carefully as self-management could arguably increase treatment burden. Furthermore, streamlining the process of arranging appointments and improving access to healthcare professionals may reduce treatment burden. Improving health literacy by ensuring clear explanations and understanding of information related to PD are other ways that can reduce the treatment burden. Ensuring adequate control of NMS may increase the physical and mental ability of PwP, which can enhance their capacity to manage treatment burden. Addressing polypharmacy through regular structured medication reviews, or potential pharmacological developments to reduce the frequency of medications and encouraging the utilisation of practical strategies to help medication burden may also be helpful.

5.6 Implications and Next Steps

Integrating the survey findings with the findings from the systematic review and interviews, the key influences of treatment burden and capacity in PD relate to arranging appointments, access to healthcare professionals, managing medications including frequency of medication, information provision and health literacy, as well as difficulty making lifestyle changes. There are potential ways that can improve this at individual and system levels. Work Package 4 involved focus groups with key stakeholders to discuss these issues and prioritise recommendations of ways to improve the treatment burden and overall experiences of PwP and caregivers. This is described in the next chapter.

Chapter 6 Work Package 4 – Multi-stakeholder Focus Groups to Develop Recommendations for Change

6.1 Introduction to Chapter

The preceding chapters of this thesis have described Work Packages 1-3 of the PD Life Study that explored the experiences of treatment burden and capacity in PD. This chapter will describe Work Package 4 which involved focus groups with multiple stakeholders. The methodological considerations for conducting focus groups were previously described in Section 2.9 (page 101).

6.1.1 Rationale

Findings from the qualitative systematic review (Chapter 3), interviews (Chapter 4), and a national survey (0) with PwP and caregivers have identified the key factors that impact the treatment burden and capacity in PD. These relate to issues with: 1) attending appointments and interactions with healthcare professionals, 2) satisfactory information provision, 3) managing prescriptions and medications, and 4) personal life adaptations. Table 18 (page 189) first summarised the issues identified from the systematic review and interviews, whilst Table 39 (page 241) built on this further to include the novel survey findings. The previous Work Packages also highlighted potentially modifiable factors at individual and system levels that could either reduce treatment burden or enhance capacity of PwP and caregivers. Addressing these factors could help PwP and caregivers better manage the workload of looking after their health and potentially prevent poor outcomes. It was therefore important at this stage of the study to present and discuss these findings with key stakeholders involved in the care of PD including PwP and caregivers to generate potential strategies or recommendations that could improve these issues.

6.1.2 Aim

The focus groups aimed to develop recommendations of ways to improve treatment burden and capacity among PwP and their caregivers based on the key issues identified from the previous Work Packages of this research.

6.2 Methods

6.2.1 Participant Recruitment and Sampling

A purposive sample of key stakeholders was invited to participate in online focus groups. These included PwP, caregivers, and healthcare professionals involved in the care of PD: PD specialists, PD nurse specialists, general practitioners (GPs), pharmacists, physiotherapists, and occupational therapists. The inclusion criteria were adult participants (age >18 years old) with the ability to provide consent who were patients diagnosed with PD; caregivers of someone with PD; or healthcare professionals involved in the care of PD. PwP and caregivers who had already participated in the one-to-one interviews in Work Package 3 were specifically not invited to capture a broader range of views and experiences of treatment burden.

PwP and caregivers were recruited via two local PD clinics in Hampshire and Dorset. Interested participants were given a participant information sheet and reply slip with a free-post envelope after their clinic appointment following consent from their clinician. Healthcare professionals involved in the care of PD identified through Wessex local services, Wessex Parkinson's Excellence Network, and my supervisors' professional networks were invited to the study and sent a participant information sheet. All participants were given at least 24 hours to read through the participant information sheet. Once participants agreed to participate in the study, they were sent the online link to join the focus group and a brief one-page summary of the issues of treatment burden and capacity (see Appendix N, page 415) to be discussed during the focus group. Written consent was obtained.

6.2.2 Data Collection

Three online focus groups were conducted using Microsoft Teams® between May and July 2022. Online focus groups were conducted to enable participation from across the whole Wessex region

from those who may find it difficult to travel and attend a focus group in person. Two focus groups consisted of PwP and/or caregivers together with healthcare professionals, with one focus group consisting only of healthcare professionals. The methodological considerations for the composition and mode (face-to-face vs online) of focus groups were previously discussed in Section 2.9 (page 101). One participant (clinical community pharmacist) did not have access to a video camera due to technical issues but joined in the discussion via audio call. Whilst I was unable to pick up on any potential non-verbal cues from this participant, it did not have any impact on their contribution to the discussion and they were able to voice pertinent recommendations for change throughout. Each focus group was moderated by myself. I took brief written notes during the focus groups to summarise the key recommendations for each issue to generate discussion and check for validation from participants. The focus groups were video recorded via Microsoft Teams® which included an automatic transcription feature. However, I found that the precision of the transcription software was poor, and therefore I edited the transcripts whilst listening to the recording to ensure that the transcripts were accurate and the anonymity of participants was maintained before data analysis. The recordings were deleted immediately following the completion of transcription.

The focus group guide (see Appendix O, page 417) was developed based on the key issues of treatment burden and capacity identified from the previous Work Packages as described above. The introduction included a brief background of the study and a reminder of the aim of the focus group. Ground rules (e.g. listening and respecting others, confidentiality) and giving "permission" for participants to ask for a break for medications or other reasons were included before starting the discussion. Participants could raise their hand using the Microsoft Teams® button or in person through the video camera if they wanted to share their thoughts. Participants were then asked to introduce themselves, their role in PD, and how they would like to be addressed. Each treatment burden issue was then presented to participants in turn, and they were then invited to reflect on their experiences with the use of open questions to generate ideas and discussions of ways or recommendations to improve the key modifiable issues of treatment burden and capacity in PD.

As anticipated, most participants initially described their experiences that resonated with the issues of treatment burden and capacity identified. Whilst this was important to allow them to relate to the issue, I ensured that I prompted them with open questions to redirect the focus towards generating recommendations to improve these issues. Many of the recommendations were suggested by healthcare professionals. It was therefore important for me to include the PwP and caregiver in the discussion by checking with them whether they agreed with the suggested changes and giving them time to consider if they had any other suggestions for improvements. There were occasional times when participants veered off topic such as a person with PD asking

about the potential genetic inheritance of PD. I made sure I acknowledged their concerns but stated that it was not part of the focus group topic, and offered to speak to them after the focus group was finished if required before guiding the discussion back to the issue at hand. During the focus groups, I actively looked for non-verbal cues through the video cameras where possible and regularly asked if participants had anything else to add after each issue was discussed.

6.2.3 Data Analysis

Data were analysed using thematic analysis. Thematic analysis has previously been described in further detail in Section 2.7.3 (page 89). Taking notes during the focus group, editing transcriptions, listening to the recordings, and reading the transcriptions multiple times enabled me to immerse myself in the data. Participants experiences of the challenges that contributed to managing PD were in line with issues of treatment burden and capacity identified from the previous Work Packages. Initial data were coded inductively based on recommendations generated for each of the separate issues of treatment burden discussed (appointments, information, medications) during the focus groups. Mindmaps were then used to determine the interlinks and connections between the codes to generate the overall themes of recommendations. The codes and themes were closely reviewed and revised by KI and then discussed with the wider supervisory team.

6.2.4 Reflexivity

This was my first experience moderating focus groups. My supervisor (KI) was present during the first focus group for support and gave feedback on how I ran the discussion. She was very impressed and happy with the flow of the conversation and how I handled the discussion, which gave me confidence for the subsequent two focus groups. Compared with conducting interviews, I had to be aware of the different roles of participants so that I could draw on their experiences and backgrounds. It was difficult at times to get a balanced view from every participant in the focus group whilst being careful not to interrupt more vocal participants. However, I felt that I was able to handle this well by directing follow-up questions to the other less vocal participants in the group and asking for their views. During the focus groups, I introduced myself with my first name and my role as a researcher at the University of Southampton. However, most participants (except four healthcare professionals) had previously met me in person before the focus groups in my role as a specialist registrar in geriatric medicine in a clinic setting. Although the knowledge that I was a clinician may have limited open and honest discussions, particularly from PwP and/or

caregivers, I felt that having met in person, I was able to easily build rapport with participants even though the focus groups were held online and that they felt comfortable with sharing their views. My role and experiences as a clinician may have also influenced data analysis as my perspectives are focused on generating information that can benefit patients. While this may be a benefit as I have an understanding of the complexities of the healthcare system, this may also prevent a more unbiased interpretation of data. Familiarising myself with the data and discussions with my supervisors helped reduce this bias. Other advantages and disadvantages of conducting qualitative research as a clinician were discussed in Section 2.10 (page 103).

6.3 Results

6.3.1 Participants

There were 11 participants in total including three PwP, one caregiver and seven healthcare professionals. Table 40 summarises the participants within each focus group and each participant's ID that corresponds to the quotes in the following sections. Participants with PD were all male, diagnosed with PD for eight months, six years and 15 years previously. The caregiver participating was the daughter of someone diagnosed with PD for seven years. The focus groups lasted between 55 and 80 minutes.

Table 40: Focus Group Participants

Focus Group Number	Participants	ID
FG1	Person with PD	P01
FG1	Caregiver for person with PD	P02
FG1	PD specialist doctor	P03
FG1	PD specialist doctor	P04
FG2	Person with PD	P05
FG2	Person with PD	P06
FG2	Community clinical pharmacist	P07
FG2	Community clinical pharmacist	P08

FG3	PD specialist doctor	P09
FG3	Consultant old age psychiatrist	P10
FG3	Community physiotherapist	P11

PwP and caregivers in the focus groups described treatment burden experiences that resonated with findings from the previous Work Packages with no new issues reported. Healthcare professionals echoed the challenges related to the lack of communication between healthcare services, poor care coordination, lack of shared medical records, and inability to access other outpatient clinic letters or prescription information of their patients. They also described the barriers they experienced with the delivery of PD services due to commissioning deficiencies. For example, one PD specialist described the reduction of PD clinics from three times a week to once a week and the lack of commissioning for local PD education groups for newly diagnosed patients.

6.3.2 Recommended Changes to Reduce Treatment Burden or Enhance Capacity in Parkinson's disease

The recommendations of ways to improve the experiences of treatment burden and capacity were categorised into four themes: 1) Visibility of Parkinson's, 2) Improving availability and organisation of healthcare services, 3) Improving interactions with healthcare professionals and information provision, and 4) Embracing the role of technology.

6.3.2.1 Theme 1 - Visibility of Parkinson's

This theme describes the recommendations for reducing treatment burden or enhancing capacity through labelling of PD diagnosis and increasing education and awareness of PD amongst healthcare professionals.

6.3.2.1.1 "I have Parkinson's"

One focus group discussed the benefits of having a "Parkinson's" diagnosis as a key that could help prioritise access to healthcare professionals for PwP and caregivers. This may also help healthcare professionals acknowledge the need for an individualised approach that considers the holistic needs of PwP and their caregivers. Participants with PD in the focus group welcomed the "Parkinson's" label if this could improve their experiences of managing their health.

"I think it would be nice to have that badge really so that you get a priority… I would be happy to have that on my shirt." P05, PwP

Having this label of "Parkinson's" may also reduce the difficulties experienced by PwP with getting PD medications on time during hospital admission.

"But I think that when it happened in the hospital and everybody knew that oh, actually yeah, they can't afford to wait for a delay in their medicines because they've got Parkinson's, that if you had some kind of "badge", almost that would get you in from an access point of view." P08, Pharmacist

6.3.2.1.2 Improving education and awareness about PD

Improving education and awareness of healthcare professionals about the complexity of PD could improve treatment burden. Healthcare professionals with a lack of expertise and knowledge about PD may incorrectly attribute any symptoms to PD rather than consider an alternative diagnosis. Participants discussed that providing education and increasing awareness of healthcare professionals about PD may enable them to recognise this and offer appropriate advice to PwP and caregivers rather than redirecting all issues back to PD services. This could also help PwP receive proactive rather than reactive care.

"I always feel that people with Parkinson's get a really rough deal because as soon as they're diagnosed with Parkinson's, any symptom, they go to anybody with is labelled as "It's your Parkinson's. When do you next see the Parkinson's doctor?". And over the years I've had people who've been declined knee replacements for osteoarthritis. I've had GPs who won't give painkillers to people with osteoarthritis." P04, PD specialist

One of the community clinical pharmacists described how their years of clinical experience with managing PwP meant that they felt confident reviewing any person with PD and addressing issues related to their PD. Furthermore, the consultant in old age psychiatry discussed how improving education regarding the neuropsychiatric symptoms of PD could enable appropriate triage for referrals received to ensure that PwP are seen by the right healthcare professionals with experience and competence in managing PD.

"I think we've got a real lack of understanding and awareness in our speciality about how Parkinson's is not just a motor syndrome. I think that's a huge gap in our OPMH (older people mental health) services in terms of the level of education and understanding about that." P10, Psychiatrist

6.3.2.2 Theme 2 - Improving availability and organisation of healthcare services

Recognising the limitations within the NHS resources and constraints due to the commissioning of local PD services, this theme describes participants' suggestions for potential ways to improve the availability and organisation of healthcare services.

6.3.2.2.1 Improving healthcare service capacity

<u>Increasing flexibility of appointment structures</u>

Firstly, addressing issues with the rigid structures of healthcare appointments and increasing flexibility of appointments were discussed by participants as ways that could potentially reduce treatment burden. This means patients who feel that they do not need a review could defer their routine appointment. Similarly, those who needed to be seen more frequently can arrange to do so. Patient-initiated follow-up (PIFU) appointments were suggested, where patients can arrange their follow-up PD appointments with their PD specialist when they need them. However, a minimum length of four to six months between routine reviews was suggested to prevent services from being overwhelmed. Participants agreed that this may be suitable for PwP at the early stages of PD as symptoms were more manageable and do not lead to any limitations on daily activities.

> *"The other thing that you can do is go towards a patient-initiated follow-up… So if patients don't want to have frequent follow-ups, they can say, "I don't want that appointment in nine months. I'd rather it be a year."" P03, PD specialist*

The ability to be flexible with the length of appointment times based on patient complexity and needs was discussed, which could also improve communication between PwP, caregivers, and healthcare professionals as described in the next theme.

> *"I've just changed my appointment lengths to half an hour, 45 minutes for someone far too long, and then you know you have 15 minutes for your follow-ups that you then spend 45 minutes seeing them when you're going through all their very difficult problems." P09, PD specialist*

Group appointments with PD specialist doctors or PD nurse specialists either face-to-face or virtually were discussed. This may help PwP and caregivers get advice from healthcare professionals or learn from others in the same situation. The pharmacists in the focus groups suggested that organisational structures such as primary care networks (PCNs) which consist of groups of general practices working together with a range of local providers across primary care,

community services, social care, and voluntary sectors may enable this to be organised within the community for PwP and caregivers.

> *"I think perhaps there are some great things about working together and maybe some group work. And even if a Parkinson's nurse can't see everyone individually, perhaps some group sessions within a PCN, not necessarily on a frequent basis." P07, Pharmacist*

Improving access to healthcare professionals

Although the key role of PD specialist nurses was discussed as a point of contact for PwP and caregivers, issues accessing them were described in the interviews and echoed by focus group participants. Therefore, depending on the problem experienced by PwP or caregivers, having a single-point of access service could either signpost them to the most appropriate resource or arrange for the appropriate healthcare professional be it the PD specialist, GP, or pharmacist to contact them with advice, or organise a clinical review. This may be led by an appropriately trained clinical administrator or wider members of the multidisciplinary team (MDT) such as a general nurse.

> *"It just helped that there was someone who could give us some advice and also she then decided that actually my mother (with rheumatoid arthritis) does need a consultant appointment and has gone ahead and arranged that. So that idea of just qualified nurses who can give both advice and take it forward. It's moving it on to the next step if you need it. It certainly has worked very well in that service. I haven't had the same access to the Parkinson's service at all." P02, Caregiver*

Participants also discussed how enabling early referral and access to physiotherapists at the beginning of diagnosis of PD could help reinforce the importance and benefits of physical activity throughout their illness.

> *""You've been newly diagnosed. Right. These are the exercises you need to do every day for the rest of your life." That's what we need to be saying, not when they've got such advanced dementia they can't follow what you're doing." P09, PD specialist*

A virtual ward MDT approach led by a PD specialist with access to physiotherapists, occupational therapists, nurses, and formal carers for PwP with complex needs within the community was also discussed. This could potentially allow proactive care with input from appropriate services in the community to potentially prevent acute hospital admissions.

"I guess the virtual ward has got this really nice, for those being managed in the community and that sort of MDT approach… And they (patients) are actively discussed, bloods may be taken, therapists going in, nurses going in, carers acutely going in." P09, PD specialist

6.3.2.2.2 Improving care coordination between healthcare services

Improving communication between healthcare services

Improving the speed of communication between healthcare services was discussed to potentially reduce treatment burden in PD. For example, rather than communication through dictated clinic letters that had to then be typed and sent out, communication between other healthcare services with the PD specialist through email or telephone was suggested. This was perceived to enable better patient-centred care for the person with PD, regardless of which part of the health service they were using.

"There are some GPs that I work with who they've got my mobile number, they know they can phone me if they've got a problem with someone with Parkinson's, they know they can ping me an email." P04, PD specialist

Ensuring access and use of shared online medical records to all healthcare professionals was also discussed, which links to the role of technology described in Theme 4. This could ensure that healthcare professionals can get a complete overview of all the clinical issues and an accurate medication list for PwP. However, not all healthcare professionals who worked in different areas within Wessex had access to patients' records.

"So in hospital A, all our clinic notes go onto the online system and no clinician at (hospital B) or someone who's not got access to the online system can access it." P04, PD specialist

Another recommendation discussed was the potential of regular forums for healthcare professionals involved in the care of PD from different services to help improve awareness of the available services within the region. This could also enable a MDT discussion for PwP with complex health needs.

"I think it would be nice if we had some sort of regular forum, if only just to familiarise ourselves with who we know who, who we are and what we do. And get started to get

some informal general advice, if we can progress that to specific case discussions about challenging patients that will be fantastic.“ P10, Psychiatrist

Supporting PD medication changes

One of the recommendations to potentially overcome treatment burden issues experienced due to PD medication changes was the use of the NHS primary care prescription forms (FP10) by PD specialists. This could avoid the delays of prescription changes that have to be implemented by GPs as PwP or caregivers would be able to take the FP10 prescription directly to the pharmacy to obtain the medication.

“One of the few nice things of when the service changed in (local area) was that I got given an FP10 pad. So, I could write the prescription for the person there and then so they could start their medication that day, tomorrow if they went to the chemist as opposed to having to, you know wait for a GP, either me to fill in a GP medication sheet which then gets treated like a repeat prescription, so you're talking five days plus.” P04, PD specialist

However, this was recommended with caution as the prescriber may not have full access to the person with PD’s medication history, potentially causing drug interactions, particularly for those with multiple medications. Access to shared medical online records as described above may reduce this risk.

“But that's actually been met with some concern from GPs, because they feel that the hospital specialist doesn't that necessarily have access to all of the rest of the information for that patient. So they merrily start a medication, but don't think about the other conditions. So they might change your Parkinson's meds and not realise the rest of the medication that you're on.” P07, Pharmacist

The presence of a pharmacist or pharmacy technician in primary care may also help support PwP and caregivers enact any medication changes recommended by the PD specialist. For example, once the pharmacist in primary care receives the clinic letter from the PD specialist, PwP will be contacted to offer support with PD medication changes.

“In an ideal world, what I would then like to happen is obviously when that (PD) clinic letter is read in a GP practice, somebody will then contact you again to reiterate the same information. And that is what we're trying to work towards.” P07, Pharmacist

6.3.2.3 Theme 3 - Improving interactions with healthcare provision and information provision

This theme describes recommendations to improve interactions between healthcare professionals and PwP and caregivers, which could help reduce treatment burden or enhance their capacity.

6.3.2.3.1 Clear communication and setting expectations

Some healthcare professionals described how clear communication about what to expect with PD, reassuring PwP and caregivers that their symptoms experienced were not only part of their PD, but also commonly experienced by other PwP could help them manage their health better. Addressing both PwP and their caregivers individually during healthcare appointments may help explore issues of treatment burden that may be different for the person with PD and the caregiver.

> *"And this whole normalizing it. Trying to persuade my parents that some of the things my father is struggling with are A: due to the Parkinson's, and B: completely normal for somebody with Parkinson's is extremely helpful because it's so difficult to get them to accommodate." P02, Caregiver*

Participants discussed the use of clinic letters to improve communication with PwP and caregivers about the outcomes of their appointments. For instance, copying patients into the letters for their GP but explaining medical terms in brackets or highlighting a lay summary at the beginning or end of the letter could help reiterate the information discussed with PwP and caregivers during the appointment.

> *"I write to the GP, copy to the patient and then copy to (PDNS) plus to any other health professionals who've been directly involved. And I try and explain all my terms in brackets." P09, PD specialist*

Furthermore, setting clear expectations by PD specialists about the urgency of medication changes to PwP and caregivers could help reduce the treatment burden.

> *"I often stress to the patient and their carer there if I am changing the medication, is that for the most part, it's not urgent... This can filter through over the next 2-3 weeks. Because otherwise, they think, "Oh I've seen the consultant. They must change it today." And a lot of that is about expectation setting." P03, PD specialist*

Improving how healthcare professionals work together with PwP and caregivers to address their concerns and recognising that PwP and caregivers are experts in their health could empower them to manage their PD.

> *"I think people working with people with Parkinson's, it's very much about this partnership approach, isn't it? It's about helping put people in control of their own illness and making them the experts." P04, PD specialist*

Due to the progressive nature of PD which can impact their ability to follow exercises, the community physiotherapist recommended that focusing on fewer exercises that may benefit PwP most such as working on stability and transfers could prevent them from feeling overwhelmed. Furthermore, educating patients about the impact of poor posture on other symptoms of PD such as swallowing could help them continue with the recommended exercises.

> *"And so that's why it's taking 2-3 exercises. I noticed that helps and with the group that I've seen, that tends to be too much already for them. And then if you start giving too much then they start losing interest." P11, Physiotherapist*

6.3.2.3.2 Opportunity to signpost towards information and services

Participants discussed that most of the information available from Parkinson's UK was very helpful and can be individualised based on the symptoms and issues experienced. For example, there were specific leaflets on PD symptoms such as anxiety and constipation, as well as leaflets regarding living aids including medication management using pill timers. The information was available online and on paper to be distributed to PwP and caregivers at their healthcare appointments. Information provided based on personal preferences can help some PwP and caregivers be proactive about their future progression with PD and make plans about their wishes for their future health and well-being.

> *"You know that this patient has started talking about their anxiety and there is a leaflet pertaining to that. In my general age group of patients, most of them don't have access to the Internet. So these are all available as PDFs online, but most of them prefer a paper copy, which is why I find it quite useful." P03, PD specialist doctor*

> *"Can I get access to some of these leaflets? That would be extremely helpful." P02, Caregiver*

Participants discussed that whilst information and support from Parkinson's UK are freely available to everyone, not every PwP and caregiver may be aware of this useful national resource. Furthermore, some may also find the Parkinson's UK website difficult to navigate. Therefore, ensuring appropriate signposting on the various modes to utilise the resources from Parkinson's UK from both primary and secondary healthcare services could ensure the consistency of information provided and access to wider support available to PwP and caregivers. For example, the First Steps programme and Parkinson's Connect by Parkinson's UK are available to those newly diagnosed with PD. Local Parkinson's UK support groups may hold speech therapy, singing courses, or therapies such as PD dance or tai chi which may help delay the progression of PD, although wider availability of these within the region was recommended.

> *"So yeah, I think everyone using Parkinson's UK as a kind of national resource. It's good to have kind of central point so that everybody is using the same information." P07, Pharmacist*

Participants also discussed the benefits of local educational courses for PwP and caregivers provided by different members of the MDT involved in PD including PD specialist doctors and nurses, physiotherapists, occupational therapists, dieticians, speech and language therapists and pharmacists. This not only provided information to PwP and caregivers but also allowed access to healthcare professionals for any questions they had. However, poor staffing issues due to the lack of healthcare service and volunteer capacity meant that these local courses were discontinued prior to the COVID-19 pandemic.

> *"Patient education courses and things like that are a brilliant way to do things. It's just trying to work within the parameters of commissioning and time, and you know all the NHS treacle that we have to wade through to do anything." P03, PD specialist*

One healthcare professional also suggested having a local resource of information that can be used to signpost PwP and caregivers to the services and activities available to them.

> *"I think some of the therapies for which there's evidence that would be great, wouldn't it? So like the PD dance that, you know, I know there's a course that runs in (town), but there isn't one in (city) direction. Or Tai Chi or some of the stuff which we've got some evidence that it helps delay illness progression." P04, PD specialist*

6.3.2.4 Theme 4 – Embracing the Role of Technology

Offering various modes of appointments including through telephone or video based on patient preference and accessibility were discussed. Furthermore, the role of novel technology smartphone applications for PwP that are currently in development that can measure their PD symptoms, record PD medications, and link back to their PD specialist for review may have the potential to reduce treatment burden if used in clinical settings.

> *"I mean just using Microsoft Teams, the program we're talking on now, or something like it. So you don't have to see everyone face-to-face. But you know, I think we could make better use of technology, to you know shorten the problems between healthcare professionals and patients." P06, PwP*

The use of technology to help manage medication was also discussed in the focus groups. For instance, the use of smartphones for reminders, or a smartwatch that vibrates when medications are due may be helpful. One patient with PD also suggested the use of technology to remind others that his medications were due, such as during hospital admission, or for family or friends whilst he was doing an activity outdoors.

> *"I've got a red vibrator watch there, which can be set for 12 times a day." P01, PwP*

The use of videos to help PwP understand and follow the provided exercises rather than describing these on paper could be beneficial. Whilst it may be challenging for some PwP and caregivers to use and access technology, there were suggestions that there may be ways to make technology adaptable and more responsive for PwP who have tremors.

> *"They need to look at the videos as well to help have a better understanding cause on paper, it's really difficult to explain the movement." P11, Physiotherapist*

6.4 Discussion

Exploring the perspectives of PD service users and healthcare professionals through focus group discussions, this study has developed recommendations of ways that could potentially improve the key issues of treatment burden and capacity among PwP and caregivers identified in PD from Work Packages 1-3. The four themes of recommendations for changes are closely interlinked with each other as seen in Figure 34 on the next page. For instance, improved visibility of PD for healthcare services about the complexity and need for a holistic approach to care for PwP and caregivers could improve the availability, organisation, and care coordination of the multiple healthcare services involved in PD. This could also lead to improved personalised communication and information provision from healthcare professionals. Furthermore, embracing the role of technology with video appointments, shared medical records, or the potential use of smartphone applications for review of PD could improve access and care coordination of healthcare services, as well as improve interactions with healthcare professionals.

These recommendations could be implemented at individual and system levels. At the individual provider level, clear communication, expectation setting, and appropriate signposting from healthcare professionals to PwP and caregivers with information and services available based on their needs and personalised preferences could reduce the treatment burden related to poor interactions with healthcare professionals, information, managing prescriptions and medications, and lifestyle changes. Furthermore, the increasing use of technology for PwP and caregivers who are able to use it may also be beneficial. At a system level, widening education and awareness of healthcare professionals about the complexity and needs of PwP, flexibility with the frequency and mode of delivery of appointments (face-to-face vs telephone vs video), improving communication between healthcare services, availability of shared medical online records, removing barriers with medication changes such as the use of FP10 prescriptions by PD specialists, and the provision of single-point access for help or advice between appointments may also improve the experiences of managing their health with PD. The wider utilisation of the valuable readily available resources and support from Parkinson's UK by more PwP, caregivers, and all healthcare professionals involved in the care of PD could be an important first step to reducing treatment burden and enhancing capacity in PD.

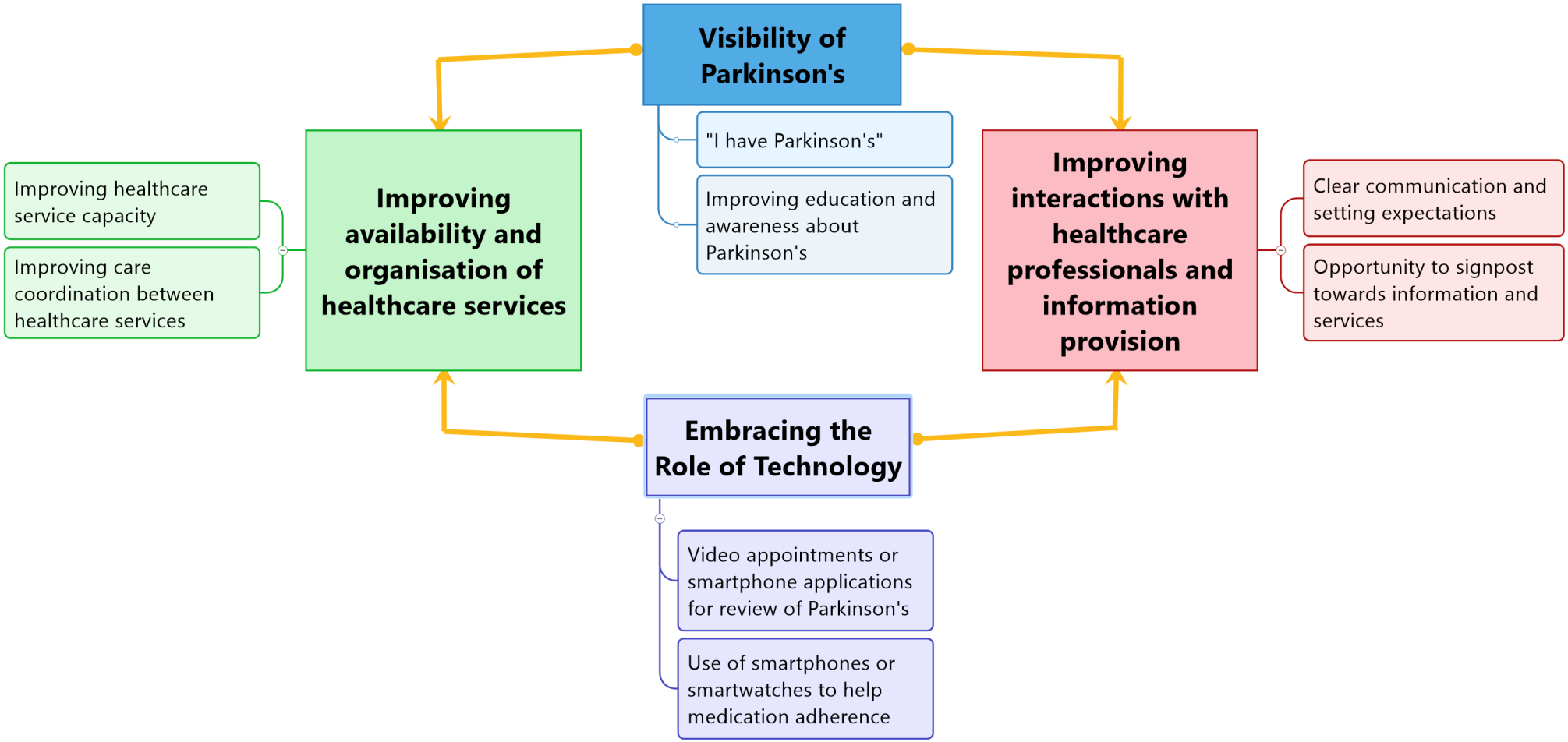


Figure 34: Interlinked themes of recommended changes

6.4.1 How does this relate to the previous Work Packages?

The recommendations for change and potential improvements at individual and system levels can be mapped against the four main aspects of treatment burden and capacity identified in the previous Work Packages (attending appointments and access to healthcare professionals, obtaining satisfactory information related to PD, managing prescriptions and medications, and personal life adaptations). These are summarised in Table 41 on the next page and will also be discussed in further detail in the next chapter (see Section 7.5, page 280). Each recommendation may lead to improvements in more than one aspect of treatment burden and capacity in PD. For example, the positive labelling of PD ("I have Parkinson's") and improving the visibility of PD could be the key to prioritising access to healthcare professionals, ensuring appropriate signposting to available resources and support for PD such as Parkinson's UK, and could also ensure timely access to medications for those admitted to hospital.

Table 41: Recommendations of ways that could potentially improve each aspect of treatment burden and capacity in Parkinson's Disease

Recommendations for change	Aspects of treatment burden and capacity that may be improved			
	Attending appointments and access to healthcare professionals	**Satisfactory information provision**	**Managing prescriptions and medications**	**Personal life adaptations**
"I have Parkinson's"	Visibility of PD diagnosis as a key to prioritising access to healthcare professionals	Signposting to available resources and support from Parkinson's UK for PwP and caregivers	Can ensure timely access to PD medication in hospital	
Improving education and awareness of Parkinson's	Recognition and awareness of PD symptoms from healthcare professionals to address issues with appropriate access to specialists Awareness of PD complexity can improve proactive care for PwP	Improve information provision related to PD based on personal preferences		Educating PwP and caregivers about the positive benefits of exercising and maintaining physical activity with PD symptom control
Increasing flexibility of appointment structures	The use of patient-initiated follow-up or group appointments could improve satisfaction with PD follow-up appointments and access to healthcare professionals			

Improving access to healthcare professionals	Single-point access can help signpost and improve access to healthcare professionals Use of virtual ward with multidisciplinary input for PwP with complex needs		Access to additional support from pharmacists in primary care with medication changes for PwP	Prompt referral and access to physiotherapy from early-stage PD can help iterate the importance of physical activity
Improving communication between healthcare services	Shared medical records and improving speed of communication can improve care coordination between healthcare services Regular multidisciplinary forum for healthcare professionals		Shared medical records and online prescription changes could reduce delays and errors in prescription changes from PD specialists to GPs and pharmacists	
Supporting PD medication changes			The use of FP10 prescriptions by PD specialists can improve issues with prescription delays and errors	
Clear communication and setting expectations	Could help normalise PD symptoms and enable shared decision-making and expectation setting which can improve interactions between PwP/caregivers and healthcare professionals	Communicating outcomes from PD clinic appointments through written letter from healthcare professionals in lay terms Improve information provision based on personal preferences and recognition of health literacy	Clear explanation about PD medications and the importance of adherence	Focusing goals and types of exercises based on ability and needs of PwP

Opportunity to signpost towards information and services	Could improve access to health, social care, and voluntary services	Improve information provision based on personal preferences	Signpost towards information to help with medication management	Signpost towards local support groups that provide exercise classes
Embracing the role of technology	The use of telephone or video appointments, or applications may improve access to healthcare professionals		The use of smartphones or smartwatches to support medication-taking	Use of videos to demonstrate exercises

6.4.2 How does this relate to the current literature?

As treatment burden and capacity remain a relatively novel concept in the literature, no other studies have explored ways to improve treatment burden or capacity specifically in PD to my knowledge. However, a few studies conducted in other long-term conditions (LTCs) have been conducted to explore this. A UK qualitative study in 2019 was the first to explore barriers and facilitators to reducing treatment burden or maximising capacity in patients with stroke from the perspectives of stroke healthcare professionals and managers(322). They highlighted five major factors that can contribute to patient-centred care and hence potentially reduce treatment burden or enhance patient capacity. These included healthcare system structure, investment in the provision of resources, knowledge and awareness of both patients and professionals, availability of social care, and patient complexity(322). Another qualitative study aimed to explore the perspectives of nurses and allied health professionals providing support for patients with chronic disease in low-income primary care settings in Australia through interviews and case vignettes(323). The study highlighted the potential strategies that may reduce treatment burden including helping patients to navigate the system, knowledge of available resources, improving access to services, the role of technology to improve coordination between services, patient-centred support from healthcare professionals and sustainable funding of services(323). The findings from both these qualitative studies align with the themes generated in the focus groups. The focus groups also developed novel views from multi-stakeholders including service users and further highlighted the health system barriers that contribute to treatment burden in PD.

A recent systematic review of quantitative interventional studies in adults with LTCs found 11 studies that assessed the impact of the intervention on patient-reported treatment burden(324). Only three studies conducted on patients with diabetes evaluated treatment burden as a primary endpoint. A pragmatic cluster-randomised trial conducted in the UK with patients with three or more LTCs implemented a patient-centred model of care and measured treatment burden as a secondary outcome(325). This involved a MDT review with a nurse, pharmacist, and GP every six months to improve continuity, coordination, and efficiency of care. There was no significant difference in the reduction of treatment burden (mean MTBQ scores) for participants at 15 months following the intervention(325). However, patients in the intervention group were more likely to report that they were able to discuss the problems most important to them in managing their health, receive joined-up support and care, and had higher satisfaction with care(325). Although integrated and patient-care models in PD were not specifically discussed in the focus group, implementation of this as well as a single-point of access for PwP and caregivers at system

level could improve timely access to appropriate care and care coordination in PD(50). This may potentially help improve treatment burden experiences in PD, although further research is required.

Improving the flexibility of appointments through patient-initiated follow-up (PIFU) appointments and the use of telemedicine were discussed in the focus groups as ways to reduce treatment burden in PD. This could increase patient autonomy with attending follow-up appointments but also relies on adequate capacity for self-management amongst PwP and caregivers. PIFU appointments were advocated for use by NHS England in 2020 to reduce inappropriate follow-up appointments and may be beneficial in reducing the burden of appointments(326). However, studies reporting the benefits of PIFU appointments including a reduction in cost, clinician time, and saving in health service resources were not conducted in PD(327). The enforced delivery of telemedicine due to the COVID-19 pandemic has contributed to treatment burden in PD as described in the previous chapters of this thesis. Nevertheless, other studies in PD have emphasised the potential benefits of technology in improving the delivery of healthcare appointments and access to healthcare professionals. Furthermore, wearable technology such as the Parkinson's Kinetigraph smartwatch that monitors patients' movement at home for six consecutive days and relays the information back to clinicians can also function to remind them to take medications(328). This can help PwP and caregivers manage their complex medication regimes with PD. Therefore, a personalised approach based on PwP and caregivers' abilities and preferences to use technology could have an important role in improving their experiences of attending appointments, accessing healthcare professionals, and medication management.

While system level recommendations require investments of time and resources to be implemented into clinical practice and health policy, healthcare professionals can enact changes in clinical practice to reduce the treatment burden in PD. For example, ensuring clear communication, shared decision-making, providing reassurance, and expectation setting for PwP and caregivers can enable them to feel supported when managing their health. Moreover, signposting PwP and caregivers to the right levels of information available through Parkinson's UK resources can also help support patient self-management and hence reduce treatment burden or enhance capacity. These findings overlap with a qualitative study that explored healthcare professionals' perceptions of treatment burden in patients with colorectal cancer in Norway(329). They reported that healthcare professionals who establish a safe environment through trust-building and information provision, increase motivation and support for patient self-management post-operatively, and encourage family and peer support for patients can help address the treatment burden issues in colorectal cancer patients.

6.4.3 Strengths and Limitations

The inclusion of PwP and a caregiver together with healthcare professionals in two of the three focus groups held is seen as a strength of this study. This allowed discussion from differing points of view and experiences of treatment burden and capacity in PD. In the focus group without service users, although the recommendations suggested by healthcare professionals could not be discussed with a PwP or caregiver, it was felt that there were no major differences in the quality and content of discussion compared to the other two groups. Whilst the inclusion of both service users and healthcare professionals together in the same focus group could be a limitation as PwP and caregivers may be less willing to be open or honest in front of other healthcare professionals, this was not felt to be the case during the focus groups. The small number of participants within each group may have allowed for better rapport between participants and eased the discussion.

Another strength of the study is that none of the focus group participants had participated in the interviews, yet their experiences of treatment burden in PD resonated with the integrated findings of treatment burden and capacity from Work Packages 1-3. Furthermore, this study involved healthcare professionals across the Wessex region which allowed shared experiences of specific local healthcare services or systems that contribute to or reduce treatment burden in PD. However, this may also limit the generalisability of the findings to other regions of the UK due to the differences in regional healthcare systems within the NHS. A further limitation of this study was that the recruitment of healthcare professionals including PD nurse specialists and GPs was challenging and none were able to take part. Their views may have generated other recommendations for change that were not considered in this study. However, the challenge of recruitment may also reflect the current real-world issues with healthcare service capacity and pressures on the healthcare systems with limited time for healthcare professionals to participate in research studies. Although holding the focus groups online may have encouraged participation from healthcare professionals, this may have led to a selection bias for PwP and caregivers who find the use of technology more challenging. Equally, building rapport between participants online may be more difficult compared to face-to-face.

6.5 Conclusion

The focus groups with key stakeholders including PwP, caregivers, and healthcare professionals involved in the care of PD have generated potential recommendations to improve the experiences of PwP and their caregivers. Suggested changes could be implemented at individual and system levels to improve aspects of treatment burden and capacity in PD that relate to attending

appointments, information provision, managing prescription errors and polypharmacy, and personal lifestyle changes. The final chapter of this thesis will integrate the findings from Work Packages 1-4 and discuss the modifiable issues identified with recommendations for improvement in further detail.

Chapter 7 Discussion of Overall Study Findings

7.1 Introduction to Chapter

This final chapter of the thesis will first provide an overview of the overall findings of the PD Life Study which explored the treatment burden and capacity of PwP and caregivers, and the impact of frailty and multimorbidity. It will then describe the key modifiable issues of treatment burden and capacity in PD, highlight potential recommendations for changes at individual and system levels, and discuss implications for future research.

7.2 Achieving the Study Aim and Objectives

As set out in the introductory chapter of the thesis, the PD Life Study aimed to identify for the first time the key factors that influence the experiences of treatment burden and capacity in PwP and their caregivers. The study objectives were:

- To explore modifiable factors that impact treatment burden and capacity of PwP and their caregivers
- Identify the impact of multimorbidity and frailty on treatment burden in PwP and their caregivers
- Develop recommendations of ways to improve the treatment burden and capacity among PwP and their caregivers
- Disseminate the study findings and prioritise recommendations for change

The overall study aims and objectives have been achieved from the four Work Packages described in Chapters 3-6 of this thesis (see Figure 10, page 66). Firstly, the **systematic review** explored the experiences of treatment burden in PwP and caregivers. Eton's framework of treatment burden was a useful starting point for identifying treatment burden in PD, with the main issues of treatment burden relating to the work and challenges of medications, obtaining information and learning about health and navigating healthcare obstacles at individual and system levels.

Interviews with PwP and caregivers explored these issues further. The four themes of treatment burden and capacity identified using thematic analysis were: 1) organising healthcare appointments and access to healthcare professionals, 2) getting satisfactory levels of information

related to PD, 3) managing prescriptions and medication issues and 4) personal life adaptations. Aspects of capacity include driving ability, access to a car, use and access of a computer, health literacy, housing proximity to amenities, use of prescription delivery services, routinisation and use of pill devices and reminders to help medications and lack of financial constraints. Other aspects that impacted PwP and caregivers' overall capacity to manage treatment burden included their personal approach and strategies to manage PD, other life responsibilities and the presence of practical and emotional support from social networks.

The **national survey** built on the findings from the systematic review and interviews, and for the first time determined the extent and levels of treatment burden using the Multimorbidity Treatment Burden Questionnaire (MTBQ) among PwP and caregivers. The survey identified that the majority of PwP and caregivers experienced treatment burden, with 21% of PwP and 50% of caregivers reporting high treatment burden levels. Nearly half of PwP reported multimorbidity and frailty. Whilst multimorbidity was not associated with higher treatment burden levels, the presence of frailty in PwP may be associated with higher treatment burden levels. Worsening PD severity, higher number of non-motor symptoms (NMS), and higher frequency of medications (>3 times a day) were significantly associated with greater odds of higher treatment burden.

From the systematic review, interviews and national survey, it was clear that the overall issues of treatment burden and capacity in PD are closely interlinked with and between each other (see Figure 35, page 277). Challenges or deficiencies in each aspect could potentially lead to a mismatch in the treatment burden-capacity balance for PwP and caregivers. Importantly, PD severity, PD symptoms, and frailty may further contribute to additional treatment burden and/or reduction in capacity for PwP and caregivers. Although the national survey did not find a significant association between multimorbidity and treatment burden levels, the previous qualitative studies highlighted the additional impact of managing other LTCs alongside PD that can impact treatment burden and capacity. The use of self-reported disease count as a measure of multimorbidity may explain the lack of significant association in the surveys.

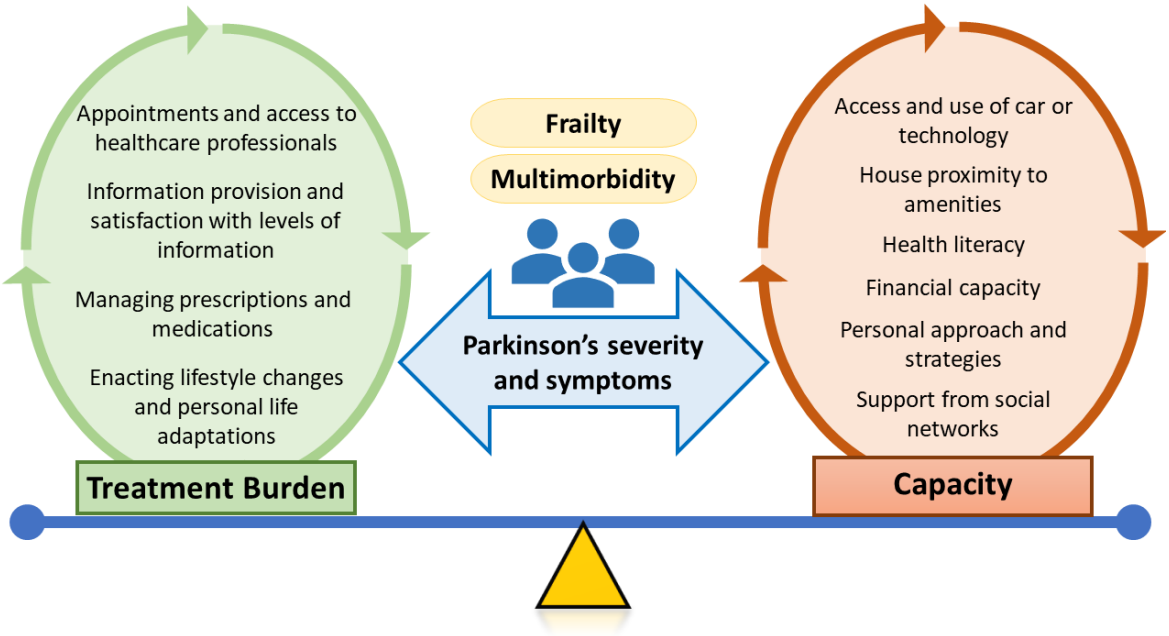


Figure 35: Treatment Burden and Capacity in Parkinson's Disease

Finally, **focus groups** with multiple key stakeholders including PwP, a caregiver, and healthcare professionals (PD specialist doctors, pharmacists, old age psychiatrist, and physiotherapist) were held to develop recommendations for change based on the key issues of treatment burden and capacity determined from Work Packages 1-3. The four themes identified were: 1) visibility of Parkinson's, 2) improving availability and organisation of healthcare services, 3) improving interactions with healthcare professionals and information provision, and 4) embracing the role of technology. The themes were closely interlinked with each other and highlighted potential improvements at both individual provider and system levels that may reduce treatment burden or enhance capacity in PD which will be discussed further in this chapter.

7.3 Experiences of Treatment Burden and Capacity in PD and How This Compares to Existing Models

The identified aspects of treatment burden and capacity in PD seen in Figure 35 are perhaps unsurprising given the progressive nature of the disease which causes multiple symptoms. However, the term 'treatment burden' may perhaps have a negative connotation that treatment recommendations from healthcare professionals are imposing on the lives of PwP and caregivers. Indeed, not all treatment burden is avoidable(91). In fact, many PwP and caregivers do recognise

the positive benefits of accessing healthcare professionals when required, adhering to PD medications, learning and understanding about PD, and the importance of physical activity in managing their PD. Furthermore, given the variability and impact of PD symptoms on the daily lives of PwP and caregivers, this workload of healthcare may be a necessity. For example, the positive response from taking PD medications can lead to improvement in the physical and mental symptoms of PwP. An important finding from this study is that many treatment burden aspects may be exacerbated due to the lack of a patient-centred approach from healthcare professionals and inflexible healthcare systems. For instance, issues related to appointments and access to healthcare professionals such as poor communication, lack of care coordination and lack of continuity of care were experienced by PwP and caregivers, not through a lack of effort from them. These aspects may be modifiable and may improve treatment burden for PwP and caregivers. Furthermore, aspects of patient and caregiver capacity need to be taken into consideration by healthcare professionals to work towards delivering holistic care in PD. A patient-centred approach could help PwP and caregivers manage their health and live well with PD despite the challenges.

As discussed in Section 1.6 (page 46), several concepts of treatment burden and capacity have been published in the literature. Eton's framework of treatment burden (Section 3.5.1, page 140) was used in this thesis as it was created with patients with multimorbidity and therefore potentially suitable for use in PD as an exemplar of patients with multimorbidity(72, 74). Whilst Eton's framework was helpful in the systematic review for identifying the issues of treatment burden in PD it does not describe the interlinked aspects of capacity which was highlighted in this study. Furthermore, both Eton's framework and The Burden of Treatment Theory (Section 1.6.1, page 47) fail to explain the impact of symptoms and severity of illness on treatment burden or capacity which was evident in PD(72, 74, 75). In comparison, Sav et al's concept analysis of treatment burden described (Figure 8, page 50) "patient characteristics" and "disease conditions" as antecedents (predisposing factors) of treatment burden, with disease severity and impact contributing to the dynamic and cyclical nature of treatment burden(95). Whilst the dynamic and cyclical nature of treatment burden proposed by Sav et al may relate to the experiences of PwP and caregivers due to the variability of PD symptoms, PD symptoms and severity are more likely to be important contributing factors of treatment burden and capacity in PD rather than a predisposing factor.

Therefore, the Cumulative Complexity Model (Figure 4, page 44) perhaps fits most closely to the treatment burden and capacity in PD(76). Firstly, the model describes complexity due to the imbalance between patient workload and capacity, describing the close interaction and relationship between treatment burden and capacity as also seen in PD. Secondly, it also

highlights the influence of the "burden of illness" which can impact patients functioning and QoL and consequently decrease patient capacity to manage the workload of healthcare. Furthermore, the model proposed that illness burden may directly lead to poor health outcomes which can then result in the intensification of treatment by healthcare professionals. This aligns closely with the study findings that PD severity and symptoms are important facets that influence the experiences of treatment burden and capacity for both PwP and caregivers. The Cumulative Complexity Model also forms the basis for achieving "Minimally Disruptive Medicine", an expression of healthcare for and about the whole person recognising the complexities for patients and caregivers in managing healthcare demands(73, 83). Achieving this for PwP and caregivers first requires recognition of the potentially modifiable aspects of treatment burden and capacity that have been highlighted in this study.

7.4 Can we identify PwP and caregivers with high treatment burden?

Early recognition of PwP and caregivers at risk of high treatment burden is essential. Identifying those with high treatment burden could allow proactive interventions from healthcare professionals to minimise the risk of complications and prevent admission to hospitals or care facilities(50). This study has found that the MTBQ can be used to determine the extent and levels of treatment burden in PwP and caregivers. The short length of the questionnaire compared to other treatment burden measures means that it may be easily administered in a clinical setting. Whilst the single-item treatment burden measure was useful in identifying those without treatment burden in PD, it had moderate performance in identifying those with medium or high treatment burden levels. This means it may have value in excluding PwP and caregivers who were managing the workload of healthcare with PD well. However, both the MTBQ and single-item treatment burden measure do not easily highlight which specific aspect of treatment burden was most difficult for respondents. Whilst other treatment burden measures such as the PETS (Section 1.8.2, page 57) can assess aspects of treatment burden domains separately, it is long and therefore not yet applicable in the clinical setting.

Other than using a validated measure of treatment burden such as the MTBQ, this study has found that it may be possible to identify PwP and caregivers at risk of treatment burden using routinely assessed clinical features. PwP with frailty (assessed using PRISMA-7), higher H&Y stages indicative of worsening PD severity, higher number of NMS (using the NMSQuest), and those who report taking medications more than three times a day were associated with higher levels of

treatment burden. These clinical attributes should be routinely assessed in an outpatient PD clinical appointment. However, a recent UK survey of PwP (N=358, mean age=66 years, mean PD duration=6 years) using the NMSQuest found that between 15-72% did not report their NMS to a healthcare professional(330). Whilst the study reported that the most common barrier to help-seeking for NMS was acceptance of the symptom as part of life, some of the other barriers were concerns that treatment will require a change or addition of PD medications and a lack of priority for NMS in the consultation. Healthcare professionals should be aware of the importance of assessing these clinical indicators as it may help identify those who are at risk of high treatment burden and consequently poor adherence to management. Furthermore, healthcare professionals should be aware of the vital role that caregivers have in supporting PwP with treatment burden and ensure that their concerns are adequately addressed(50).

The PD Life study has shown for the first time that the MTBQ and key clinical indicators of PD can be used to identify PwP and caregivers at risk of high treatment burden. The use of the single-item treatment burden questionnaire could help exclude PwP and caregivers with no or low risk of treatment burden in practice. Healthcare professionals could then potentially approach those PwP and caregivers at risk of high treatment burden by asking whether they experienced difficulties with appointments, medications, information, or lifestyle changes and addressing the most burdensome aspect using the recommendations described in Section 6.3.2 (page 254) and the subsequent section of this thesis. However, further research is required to determine a treatment burden measure that is easy to use and can quickly and accurately highlight the most burdensome aspect of treatment burden experienced by PwP and caregivers for healthcare professionals to address within a routine clinical setting.

7.5 Key Modifiable Aspects of Treatment Burden and Capacity for PwP and Caregivers and Recommendations for Improvement

This study has identified many aspects of treatment burden and capacity experienced by PwP and caregivers, some of which may be modifiable. This section will therefore draw on findings from the focus groups (see Table 41, page 267) to discuss the key modifiable aspects within each of the four main issues of treatment burden and capacity in PD and the potential recommendations on how this may be improved.

7.5.1 Appointments and interactions with healthcare professionals

Aspects of treatment burden and capacity due to challenges with appointments and interactions with healthcare professionals that could potentially be modified are summarised in Table 42. These are: 1) poor interactions and relationships with healthcare professionals, 2) frequency and quality of appointments, 3) difficulty accessing healthcare professionals and poor availability of services and 4) lack of coordination and continuity of care.

Table 42: Modifiable treatment burden issues related to appointments and interactions with healthcare professionals

Key modifiable aspects of appointments and interactions with healthcare professionals	Recommended changes for improvement
Poor interactions and poor relationships with healthcare professionals	• Improving communication and interpersonal skills of healthcare professionals through training programmes
Frequency and quality of appointments	• Use of patient-initiated follow-up appointments • Hybrid appointments with the use of telemedicine where appropriate • Integrated care pathways to align appointments
Difficulty accessing healthcare professionals and poor availability of services	• PD diagnosis as positive labelling to prioritise access to healthcare professionals • Improving education and awareness of PD • Single-point of access that can signpost towards information or access to the appropriate healthcare professional
Poor communication and lack of care coordination between services	• Improving the speed of communication and use of shared online medical records • Integrated models of care

7.5.1.1 Poor interactions and poor relationships with healthcare professionals

The issues reported by PwP and caregivers from the systematic review and interviews relate to poor interactions and poor relationships with their PD team and GP which may reflect a lack of holistic approach, lack of patient-centred care and lack of shared decision-making. A USA study using the PETS treatment burden measure in people with hypertension (N=254, mean age=67

years) found that patients who reported poor communication and interpersonal skills from healthcare providers had higher treatment burden levels(331). Furthermore, a cross-sectional survey of people with multiple LTCs (N=332, mean age=66 years) found that better patient-provider relationship quality reported by patients was associated with lower treatment burden, better self-management, and better psychosocial outcomes(332). The authors posited that proficiency in patient-centred communication by all healthcare professionals involved in the management of patients with a LTC may improve treatment adherence and patient outcomes(332).

Recommendations

- Improving communication and interpersonal skills for healthcare professionals

The interviews with PwP and caregivers found that continuity of care with good communication and clear explanations from healthcare professionals meant that they were able to build trust and relationships with healthcare professionals and therefore felt more able to manage their PD. Ensuring positive relationships and improving patient-centred communication between patients and healthcare professionals could help reduce treatment burden in PD(93, 332). It is possible to improve the communication and interpersonal skills of healthcare professionals involved in the care of PD through specific training strategies which could then reduce treatment burden among PwP and caregivers. For example, a systematic review on the effectiveness of communication skills training for healthcare professionals reported that training strategies that utilised role-play with real or simulated patients, provision of structured, direct, or written feedback in combination with practical communication skills and small group discussions were effective ways of teaching communication skills(333). A RCT conducted with clinicians (N=42) working in a German hospital setting aimed to explore the effectiveness of a training-induced improvement on patient-centred communication(334). The training was developed following a needs assessment and consisted of theoretical and small group practice, role play with and without simulated patients and feedback. The trial reported a significant improvement in the amount of patient-centred communication behaviour, with no significant differences in the length of conversations between patients and clinicians.

7.5.1.2 Frequency and Quality of Appointments

This study found that some PwP and caregivers were dissatisfied with the frequency of PD appointments and quality of appointments which contributed to their treatment burden experiences. Current NICE guidelines for PD recommend reviews at regular intervals of six to 12

months with a PD specialist, although no studies have researched the most appropriate frequency of follow-up after the initial diagnosis of PD(20). Parkinson's UK conducted two surveys to assess the impact of the COVID-19 pandemic and reported that PwP and caregivers experienced delayed or cancelled appointments and unexpected changes from face-to-face to telephone appointments which respondents felt were more stressful and felt left out of conversations compared to face-to-face appointments(303, 335). This may have contributed to higher treatment burden. From the PD Life surveys, it was difficult to delineate using the MTBQ whether the difficulties with seeing different health professionals or attending appointments reported by PwP and caregivers were for PD or other LTCs. A retrospective matched-group study in Canada found that PwP (N=1469, mean age=74 years, 51% had 2-5 comorbidities) visited a physician 1.6 times more often per year compared to the control group(336). Furthermore, a small retrospective study (N=33, mean age=76 years) in the UK found the mean number of GP consultations for PwP was seven times (range 1-17) a year(337). Whilst PD was the most frequent single reason for seeing their GP, the study reported that most GP consultations were for health conditions other than PD. Therefore, this may well be an indication of the impact of multimorbidity in PwP leading to a higher number of healthcare appointments with lots of different healthcare professionals and contributing to treatment burden.

Recommendations

- Use of patient-initiated follow-up appointments

The need for flexible appointment systems with regards to the frequency of follow-up appointments and allowing for longer consultations depending on the length of PD diagnosis, PD severity, and more importantly patient and caregiver needs may help address the treatment burden. Flexibility with appointment structures and patient-initiated follow-up (PIFU) appointments were discussed in the focus groups as ways that could improve treatment burden. However, PIFU appointments place the responsibility on patients and/or caregivers, relying on them to judge when they need an appointment based on their symptoms and related concerns. This could paradoxically increase treatment burden for some PwP and caregivers. A systematic review (N=8) of UK studies in health conditions other than PD reported potential benefits of using PIFU appointments in reducing costs, clinician time, and savings in health service resources with no evidence of harm to patients(327). The authors acknowledged the limitations in the quality of reporting of studies with large heterogeneity in populations and outcomes in the included studies. Despite some evidence of the benefits of PIFU appointments to patients, clinicians, organisations, and systems, it remains unclear whether this can be implemented in a cohort of complex patients with increasing severity and progressive symptoms such as PD(326).

- Hybrid appointments and the use of telemedicine

The focus groups also discussed the role of technology and the potential use of telemedicine or hybrid appointments in reducing treatment burden for PwP and caregivers. The poor experiences reported by PwP and caregivers with telephone appointments in this study may be due to the forced, unexpected changes because of the COVID-19 pandemic. However, appropriately planned implementation of telemedicine for suitable patients may potentially reduce treatment burden for PwP and caregivers, whilst also being of value to healthcare professionals and healthcare systems(304, 306, 338). For instance, Miele et al described that the utilisation of validated motor and non-motor scales, patient-reported outcome measures, and electronic diary monitoring to assess patients remotely may help improve the quality of care in patients with chronic neurological disorders(339). Furthermore, a RCT involving 195 PwP compared usual care to usual care supplemented with virtual visits via video conferencing from a PD specialist to patients' homes(340). The study found that compared to usual in-person care, participants preferred virtual visits over in-person visits (55% vs 18%, $p<0.0001$), virtual visits saved patients time (median=88 minutes, $p<0.0001$) and reduced travel distances (median=38 miles, $p<0.0001$). However, all participants had access to their own private, internet-enabled devices and therefore findings may not be generalisable. Whilst the efficacy of telemedicine in PD continues to be evaluated and its' optimal method of delivery refined, the ever-increasing demands on healthcare services in the NHS mean that it has the potential to be a useful tool for many situations(304).

- Integrated care pathways

The use of integrated pathways could reduce appointment burden of seeing different healthcare professionals in PD and potentially improve treatment burden. A systematic review and meta-analysis of integrated care models in PD (N=48) across the world reported many proposed models across inpatient care, outpatient appointments and community-based settings at varying levels of integration(341). However, none of the studies included in the systematic review measured treatment burden as the primary or secondary outcome. A Danish study explored the feasibility of a novel Multidisciplinary Outpatient Pathway for patients with multimorbidity (N=102, median age=71 years) who were reviewed in multiple different outpatient clinics such as respiratory, cardiology, endocrinology, rheumatology, and nephrology specialist clinics(342). They found that 43% of participants reported medium or high treatment burden at baseline. The intervention consisted of three elements: 1) proactive identification of patients by nurse care managers experienced with coordinating care leading to consecutively scheduled appointments, 2) handover of a summary with care-related information over to the subsequent clinic, and 3) a multidisciplinary conference involving patient's healthcare professionals resulting in a joint care

plan. Although the study did not look at changes in treatment burden levels following the intervention, the Multidisciplinary Outpatient Pathway was feasible and led to the alignment of 15% of all appointments in one day(342). Therefore, further research is required to determine which patients will most benefit from integrated care pathways for PD, and the impact of this on treatment burden levels for PwP and caregivers.

7.5.1.3 Difficulty accessing healthcare professionals and poor availability of services

The PD Life study reported that difficulties accessing healthcare services including PD specialist doctors, PD nurse specialists, GPs, and other allied health professionals, difficulties getting help from community services, and difficulties getting healthcare in the evenings and weekends contributed to treatment burden. These findings resonate with a scoping review (N=38) by Zaman et al in 2021 that identified the barriers to healthcare services access for PwP across different countries including the USA, UK, Canada, and other countries in Asia, Europe and Australia(308). They summarised the barriers at two levels: 1) person level and 2) system level. Person-level barriers to accessing healthcare services include the inability of PwP in seeking help, the inability to engage in healthcare services, limited transportation services or the ability to drive, and costs for healthcare services. These relate to aspects of patient capacity that could potentially be enhanced in PwP and caregivers to reduce the treatment burden. The system level barriers reported by Zaman et al were firstly due to the inappropriate delivery of healthcare services because of delays in PD diagnosis, poor coordination of care, poor communication skills of healthcare providers, and disparity in healthcare systems; and secondly due to the unavailability of healthcare services, particularly PD specialists' services(308).

Furthermore, PwP and caregivers described that poor relationships with healthcare professionals contributed to their hesitancy in seeking medical advice unless necessary, particularly from their GP. Some reported reasons for this were that PwP and caregivers perceived a lack of knowledge and understanding from their GP about PD and did not want their GP to interfere with their PD management as recommended by their PD specialist. Hesitancy in seeking help from GPs by PwP and caregivers reported in this study is similar to findings from a longitudinal qualitative study in the Netherlands with 16 PwP and 12 GPs(343). Community-dwelling PwP described that they preferred not to contact their GP, especially during the early stages of PD, opting instead to try and self-manage, or turning to specialised care for any PD-specific issues. Equally, GPs reported hesitancy in being involved in PD care as they did not feel competent to do so especially due to their lack of experience with complex pharmacotherapy.

Recommendations

- Positive labelling of PD and improving the education of PD among healthcare professionals

The focus groups discussed the potential benefits of having a "Parkinson's" diagnosis as a key that could prioritise access to healthcare services, allowing PwP and caregivers to receive proactive care from the right person at the right time, potentially reducing treatment burden(50). However, this requires improvement in education and awareness amongst all members of the MDT in primary and secondary care settings about the complexity of PD. For example, educating GPs about PD could improve their interactions and relationships with PwP and caregivers which may then encourage them to seek help from their GPs when required rather than waiting for review by their PD team. This is important given the benefits of shared care between their GP and PD specialists to PwP and caregivers when managing a complex progressive chronic disease(343). A questionnaire study amongst Australian GPs (N=110) who attended a two-hour interactive educational seminar led by a consultant neurologist found that whilst there were deficits in knowledge regarding motor and non-motor aspects of PD pre-seminar, there was a significant improvement in knowledge and confidence levels of GPs post-seminar(344).

- Single-point of access

As discussed in the focus groups, implementation of a single-point of access for PwP and caregivers could improve treatment burden. Indeed, this was identified by PwP as a top priority for improvement in healthcare delivery(345). Access to PD nurse specialists is recommended by NICE guidelines as a quality standard as they have a key role in providing support for patients and caregivers, education and advice, specialist assessment skills of PD symptoms and prescribing, and care coordination(20, 346). King's College Hospital, one of only two centres in the UK accredited as a Parkinson Foundation Centre of Excellence runs an MDT model of care that nominates the PD nurse specialist as a point of first contact for PwP and caregivers(347). The PD nurse specialist can then utilise the appropriate expertise from various members of the MDT to deliver care for all stages of PD. However, the variability in the availability of PD specialist services across different geographical regions in the UK and also globally despite the rising number of PwP remains an ongoing concern(346, 348). Upskilling and training of clinical administrators, wider members of the MDT, or access to a personal case manager as the first port of call for advice could allow appropriate signposting to resources or healthcare professionals(50, 349). Although there remains a lack of research on the utility of single-point of access in PD, this could potentially improve PwP

and caregivers' experiences with accessing healthcare professionals and services, as well as appropriate information(50).

7.5.1.4 Poor communication and care coordination between services

Another potentially modifiable issue of treatment burden in PD relates to poor communication and lack of care coordination between services. This led to contradicting advice about their health, delays in prescriptions, as well as the need for some PwP and caregivers to act as the coordinator between services themselves. The lack of care coordination between health services is a well-reported issue in the care of people with chronic conditions including PD(77, 108, 158, 345).

Recommendations

- Improving the speed of communication between healthcare services

Rapid and reliable communication not just between primary and secondary care services, but between specialists through telephone or online messaging could reduce treatment burden in PD. The importance of shared online medical records was discussed in the focus groups as a recommendation that could improve treatment burden in PD. The NHS Long Term Plan published in 2019 recognised the crucial role of increasing the use of digital services and data interoperability to enable interactions and data flows between services, systems and individuals(350). Ongoing digital transformation within the NHS to improve access to complete electronic patient medical records for health and care professionals across local areas could enable better interface between services. Furthermore, the increasing range of digital tools and services anticipated with the NHS Long Term Plan will enable some PwP and caregivers to access their own medical records, view information about their health online, book appointments, and view their test results. This could also improve aspects of treatment burden related to information provision described in the next section. However, this may lead to further issues for other PwP and caregivers could be digitally excluded due to potential difficulties with using technology because of tremors or poor access to technology.

- Integrated models of care for PD

Van Der Eijk et al argued that the fragmented care that PwP experienced was often compounded by the presence of multimorbidity, with current healthcare systems and systemic barriers preventing collaborative patient-centred care in PD(351). A qualitative study involving patients with multimorbidity found that patients viewed a well-coordinated healthcare system as a

positive aspect of healthcare that may reduce treatment burden(93). The PRIME-Parkinson project by Tenison et al proposed a new integrated model of care in 2020 that aims to deliver personalised care management which may help improve care coordination and continuity of care in PD(352). This model of care comprises five components which include personalised care management, education and empowerment of patients and caregivers, empowerment of healthcare professionals, a population health approach, and patient- and healthcare professional-friendly technology. The central role of PD nurse specialists within the model is key to ensuring the development of a personalised care plan together with PwP and caregivers based on their circumstances, needs, and preferences(352). Although this is an ongoing study with no evidence yet on its' utility in clinical practice, this integrated model of care may lead to an increasingly collaborative role between PD nurse specialists and PD specialists in ensuring care coordination for PwP and caregivers. This may help reduce the treatment burden for PwP and caregivers, especially in the context of multimorbidity.

7.5.2 Information provision and satisfaction with levels of information

High treatment burden in PD was related to poor levels of information (too much information or lack of information) and difficulty understanding information provided. These are potentially modifiable aspects that could be improved to reduce treatment burden (see Table 43).

Table 43: Modifiable treatment burden issues related to information provision and satisfaction with levels of information

Key modifiable aspects of information provision and satisfaction with levels of information	Recommended changes for improvement
Poor information provision based on personal preference and stage of PD	• Tailoring information provision based on individual needs and preferences • Group education programmes • Signposting information and utilising resources from Parkinson's UK
Difficulty understanding information	• Increasing the length of appointments to allow detailed explanations from healthcare professionals • Improving health literacy through appropriate provision of information and structured education sessions

7.5.2.1 Poor information provision based on personal preferences and stages of PD

This study found that PwP and caregivers at different stages of PD may require contrasting levels of information, with increasing information needs during the early and late stages of PD. In particular, both PwP and caregivers reported a lack of information regarding the progression and potential prognosis of PD, whilst caregivers reported that information on how to best care and support someone with PD was lacking. The challenges of information provision at early diagnosis of PD align with findings from a large cross-sectional survey across 11 European countries including the UK (N=1775, mean age=70 years)(353). The study found that satisfaction of PwP was associated with the helpfulness of information provided ($r=0.52$, $p<0.0001$), the quantity of information provided ($r=0.29$, $p<0.0001$), and the time provided to ask questions ($r=0.37$, $p<0.0001$), with poor correlation with age, PD duration, and PD age of onset. Although findings may lack generalisability due to the risk of recall bias and sampling bias due to online recruitment, it highlights the important relationship between information provision and positive experiences at diagnosis for PwP and caregivers.

Recommendations

- Tailored information provision, signposting to Parkinson's UK and group education programmes

Healthcare professionals should be aware of the differences in individual information needs and preferences about PD, and that preferences of PwP and caregivers may change as PD progresses. Knowing this could ensure tailored provision of information to PwP and caregivers in formats that are easily accessible to them such as oral, written or online(354). Signposting PwP and caregivers to Parkinson's UK by healthcare professionals can enable access to information that is available in different languages and various formats including online, printed leaflets, large print, audio CDs, or easy read. Furthermore, Parkinson's UK offers a free confidential helpline, a peer support service, local advisers, local support groups, or online forums that can provide support and information for PwP and caregivers. The focus groups discussed the benefits of group education programmes for PwP and caregivers in potentially reducing treatment burden. A RCT reported the impact of eight 2-weekly sessions of 90 minutes duration education programme for PwP (N=55) and caregivers (N=50) compared to usual clinical practice(355). The study found that there were significant improvements in QoL for PwP with a reduction in caregivers' need for help following the education programme, although this was not significant at six months follow-up. More recently, Parkinson's UK launched Parkinson's Connect for patients recently diagnosed with PD and their family, friends, or caregivers to provide personalised support information and advice.

7.5.2.2 Difficulty understanding information

Difficulty understanding information also contributed to the treatment burden in PD. Aspects of capacity that mitigated this were the availability of support from family or friends and health literacy. In the survey, approximately 10% of PwP and caregivers reported limited health literacy. This was associated with increased odds of higher treatment burden levels. Low health literacy has been associated with high treatment burden levels in other quantitative studies involving patients with multimorbidity(112, 113, 319). Yet, there remains a paucity in the current literature on the extent and associations of low health literacy in PD(356).

Recommendations

- Increasing the length of appointments and improving health literacy

Flexibility with appointments and increasing appointment lengths as previously described in Section 7.5.1.2 (page 282) could allow more time for healthcare professionals to answer any questions, clarify any information, and ensure understanding of information by PwP and caregivers(345, 357). Health literacy may be improved through the appropriate provision of information and structured education sessions for PwP and caregivers as described in the previous section, as well as through effective communication from healthcare professionals(358). A recent systematic review found that 15 out of 22 interventional studies from nine countries using a variety of health literacy measures reported improvements in some aspects of health literacy among adults(359). These interventions include small group educational sessions (ranging from 40 minutes to full day sessions, twice a week to monthly, lasting two weeks to 12 months), use of a short animation video, single one-to-one ten-minute training session, remote video-conferencing, use of social media, or short telephone messaging. However, the included studies were generally poor at reporting sufficient detail about the intervention. Although none of these studies was conducted in PD, this is an emerging field with the majority of the studies reported in the review published since 2018(359). Further research evaluating the applicability of these interventions in improving the health literacy of PwP and caregivers is required to enhance their ability to manage the treatment burden related to obtaining and understanding information about PD.

7.5.3 Managing prescriptions and medications

People with Parkinson's and caregivers described potentially modifiable aspects of treatment burden related to prescription errors and collecting prescriptions, organising multiple

medications, and strategies to support medication adherence. These are summarised in Table 44 along with the recommended changes for improvement.

Table 44: Modifiable treatment burden issues related to managing prescriptions and medications

Key modifiable aspects of managing prescriptions and medications	Recommended changes for improvement
Prescription errors and collecting prescriptions	• Improving communication between PD specialists, GPs, and pharmacists • Use of FP10 prescription pads or Electronic Prescription Services by PD specialist for medication changes • Use of prescription delivery services
Organising polypharmacy and strategies to support medication adherence	• Structured medication reviews to reduce polypharmacy • Pharmacists to help simplify medication regimes • Signposting to Parkinson's UK information regarding medication aids • Use of technology such as smartwatches or smartphones to support medication taking

7.5.3.1 Prescription errors and collecting prescriptions

Errors in prescriptions and challenges collecting prescriptions contributed to the treatment burden for PwP and caregivers. This occurred due to poor communication regarding medication changes either between PD specialists and GPs, or between GPs and pharmacists despite the use of electronic prescribing systems by these services that were meant to streamline this process. A retrospective records review of older patients (N=300, mean age=84 years) from 10 UK GP practices found that 17% of medication changes requested on discharge summaries following hospital admissions were not completed(360). Other qualitative treatment burden studies in patients with stroke and chronic kidney disease in the UK have similarly reported issues with managing prescriptions(77, 108).

Recommendations

- Use of FP10 prescriptions, electronic prescribing services and prescription delivery services

Embracing the role of technology in rapid communication between primary and secondary care services including PD specialists, GPs, and pharmacists described in Section 7.5.1.4 (page 287) is essential to improve experiences of prescription management. Access to shared medical online records would enable PD specialists to get an accurate medication history and view primary care prescriptions before any PD medication changes. In addition, the ability of PD specialists to use FP10 prescription pads during outpatient appointments for medication changes was discussed in focus groups to potentially reduce treatment burden. However, this should be adopted with caution as there is a higher risk for errors compared to GP prescriptions due to illegible prescriptions or missing information on prescriptions(361). Ongoing development by NHS Digital of Electronic Prescribing Services which currently allows primary care prescribers to send prescriptions electronically to a pharmacy for use in secondary care to support outpatient prescribing changes could help overcome these challenges(362). Nevertheless, as overall continuing care of PwP and clinical responsibility for repeat prescriptions remains under their GP, robust communication and collaboration are essential(363). The availability and utilisation of prescription delivery services for PwP and caregivers could also reduce treatment burden, particularly for those who struggle to get to the pharmacist due to physical limitations. Ensuring signposting and access to prescription delivery services available at community pharmacists for PwP and caregivers could help with this.

7.5.3.2 Organising polypharmacy and strategies to support medication adherence

Another important aspect of treatment burden in PwP and caregivers related to managing multiple medications, which may be exacerbated by other LTCs such as hypertension, osteoarthritis, and diabetes. A recent systematic review and meta-analysis (N=6) published in 2022 found that polypharmacy was highly prevalent (58% had ≥5 medications) in older adults (aged ≥65 years) with PD, although there was a high degree of heterogeneity across the included studies(364). Polypharmacy is associated with many poor health outcomes including adverse drug reactions, hospital admissions, and mortality(365, 366). Findings from the PD Life surveys reported that whilst the number of medications was not associated with treatment burden, higher frequency of medications (>3 times a day) significantly increased the odds of greater treatment burden (OR 2.75; p=0.009) in PwP after adjusting for sociodemographic variables, number of LTCs, and frailty. Furthermore, trying to manage PD medication side effects or dealing

with the unpredictable PD medication response may require PwP and caregivers to access healthcare professionals outside of planned routine appointments. This could lead to an accumulation of treatment burden in PwP and caregivers who may already be overburdened. Aspects of medication use contributing to treatment burden are well-reported in both qualitative and quantitative studies in people with LTCs(96, 98, 101, 113, 296, 316).

Recommendations

- Structured medication reviews and support from pharmacists

Iqbal et al's editorial described how physicians could assess medication burden, polypharmacy, and prescribing of inappropriate medication in the context of treatment burden(366). The authors state that whilst there is no agreed consensus on the best approach to evaluate polypharmacy and appropriateness of medications, tools such as the STOPP/START criteria and American Geriatrics Society Beers Criteria® may be helpful(367, 368). Regular structured medication reviews by GPs, PD specialists, PD nurse specialists or pharmacists within the MDT underpinned by shared-decision making with PwP and caregivers may be beneficial in reducing the medication burden in PD(369, 370). Other methods such as simplification of medication regimens to reduce the frequency of medication taking by PD specialists and support from pharmacists with PD medication changes could also reduce treatment burden(371). Whilst there are potential ways to reduce the medication burden in people with multimorbidity, the number of medications or polypharmacy is not the sole contributing factor to treatment burden(114). Furthermore, one might argue that PD medications are essential in the management of motor and NMS in PD as this may also enhance physical and mental ability in PwP, which are important aspects of patient capacity. Perhaps it is therefore more important to focus on ways to enhance capacity of PwP and caregivers to manage medications, as described next.

- Signposting to medication aids and use of technology

In this study, the aspects of capacity that supported medication taking in PD included the routinisation of medications into their daily lives, the use of pill devices, medication alarms and reminders, and the use of technology such as smartwatches, smartphones, or devices such as iPad® or Alexa®. Healthcare professionals signposting PwP and caregivers to Parkinson's UK information regarding medication aids could be a simple way of enhancing their capacity to manage medications. Some of these findings resonate with a qualitative study of PwP (N=16, mean age=68 years) and caregivers (N=5, mean age=73 years) in the USA that explored their strategies to facilitate medication adherence(264). They found that the strategies used include

seeking knowledge about antiparkinsonian medications, seeking advice from family and friends, use of devices, and use of reminders.

7.5.4 Enacting lifestyle changes and personal life adaptations

Making lifestyle changes was reported as the most burdensome domain of treatment burden on the MTBQ for PwP and caregivers. However, it was difficult to determine from the surveys which specific task of lifestyle modifications was most burdensome. Treatment burden related to dietary changes, ensuring good levels of hydration, reducing alcohol intake, and adhering to low-potassium diets have been reported in previous qualitative studies with patients with chronic kidney disease(99, 108). PD symptoms such as fatigue, low outcome expectations from exercise, and lack of time are known barriers that are reported to prevent engagement in exercise for PwP(372). Furthermore, treatment burden challenges with lifestyle changes may relate to the impact of treatment burden in PD. PwP and caregivers may increasingly have to rely on their family, friends, and social networks due to their deteriorating physical and mental ability as PD progresses leading to a loss of independence. For caregivers, this may also imply caregiver burden, which was also found to be high in the surveys. Although caregiver treatment burden was associated with caregiver burden in PD, causation and effect cannot be determined from this study although these two concepts may be closely related. A summary of the key modifiable aspects and recommended changes for improving in enacting lifestyle changes and personal life adaptations is shown in Table 45.

Table 45: Modifiable treatment burden issues related to enacting lifestyle changes and personal life adaptations

Key modifiable aspects of enacting lifestyle changes and personal life adaptations	Recommended changes for improvement
Difficulty with dietary changes, maintaining physical activity and completing recommended exercises	• Behaviour change intervention and self-management strategies • Ensuring early support from dieticians, speech and language therapists, physiotherapists, and occupational therapists • Targetting specific exercises based on the ability of PwP • Signposting to local support groups for exercise classes

Recommendations

- Behaviour change intervention, self-management strategies and prompt referral to multidisciplinary services for support

Interestingly, a mixed-method descriptive USA study in adult patients with diabetes found that lifestyle changes including diet and exercise were discussed positively rather than being perceived as burdensome(373). This was seen as a way to improve patient capacity, as patients found pleasure and meaning in adopting health habits such as swimming or gardening. Therefore, perhaps enhancing patient capacity through behaviour change interventions and self-management strategies could improve self-efficacy and sustained exercise adherence among PwP and reduce treatment burden in PD(374, 375). Ensuring early referral to members of the MDT including dieticians, speech and language therapists, physiotherapists, and occupational therapists could help support PwP and caregivers with the lifestyle changes and personal adaptations due to PD(20, 375). The focus groups discussed how referral to physiotherapists during the early stages of PD could enable routinisation of physical activity into the daily lives of PwP and caregivers(375). Tailored exercises and goals for PwP by physiotherapists based on their physical and mental abilities could also encourage continued engagement with exercise(376). Furthermore, Schootemeijer et al argued that healthcare professionals play a key role in educating PwP about the importance of exercise in PD, including the benefits on general health, control of motor symptoms, and improving balance, gait, mobility and QoL (372). This also relates to the role of improving communication and information provision from healthcare professionals in reducing treatment burden described earlier in this chapter which could also support PwP and caregivers with enacting lifestyle changes.

Another recommendation that could enhance capacity to manage the lifestyle changes in PD is to ensure wider support from social networks such as joining group exercise classes, involvement and encouragement from family members or friends in exercises, or signposting to local Parkinson's UK support groups. The NHS Long Term Plan commitment to increase social prescribing link workers could help PwP and caregivers connect to these community groups and services for practical and emotional support(350). This could improve confidence for PwP and caregivers with completing exercises, as well as provide opportunities for shared experiences and socialisation(376).

7.6 Implications for Practice

Drawing on the potential recommendations described in the previous section, Table 46 provides a summary of the recommendations from this study that should be prioritised for implementation in practice by PwP and caregivers, individual providers, and at a system level to decrease treatment burden or enhance capacity.

Table 46: Recommendations for change that could decrease treatment burden or enhance capacity

PwP and caregivers	Individual providers	System level
• Increasing self-management strategies by active engagement with Parkinson's UK support networks and resources • Encouraging the use of practical support for managing prescriptions and medications such as pill devices, reminders, or prescription delivery services • Reinforcement and encouragement for PwP and caregivers to draw on existing sources of capacity and cultivate new capacity	• Role-play simulation training exercises involving PwP and caregivers for healthcare professionals to improve communication and interpersonal skills • Aim to deliver personalised care based on individual needs and wishes using a multidisciplinary team approach • Developing multidisciplinary team working between PD specialists, GPs and pharmacists to address polypharmacy and increase appropriate deprescribing • Signposting to appropriate information and services, utilising the role of social prescribing link workers • Addressing health literacy limitations using clear, balanced language aided by pictures or videos, focusing on what is important for PwP and caregivers	• Increasing education and training for healthcare professionals regarding the complexity of PD and the importance of addressing treatment burden and capacity • Availability of flexible appointment systems, development of integrated care pathways or single-point access for PD and use of FP10 prescription by PD specialists • Embracing the role of technology for shared online medical records, Electronic Prescription Services, and the use of telemedicine for appointments • Improving health literacy with small group educational sessions about PD for PwP and caregivers

7.6.1 PwP and caregivers

There may be strategies that PwP and caregivers could enact themselves to engage with treatment recommendations and healthcare services which may reduce their treatment burden or enhance capacity. This of course requires agency from PwP and caregivers themselves and may not be possible for some due to physical, mental, or psychosocial factors(75). A mixed-method study in patients with end-stage renal failure receiving dialysis treatment compared experiences between patients who reported high or low treatment burden and reported differences in self-management practices between the groups(377). Those with higher treatment burden had difficulty establishing a rhythm of life around dialysis, more disrupted biographies of their social roles and self-perception, fewer appraisal-focused coping strategies, less supportive social networks, and more negatively portrayed experiences early in dialysis. A systematic review and qualitative synthesis (N=6) reported seven themes that relate to self-management components as experienced by PwP and their caregivers(378). Medication management, completing physical exercises, monitoring their symptoms, psychological strategies such as positive thinking, maintaining independence and autonomy, engaging with social networks, and obtaining knowledge and information about PD were key components of self-management strategies for PwP and caregivers. These components overlap with aspects of patient capacity in managing PD described in this study and could help PwP and caregivers manage treatment burden. For example, the use of pill devices, medication reminders and prescription delivery services are practical solutions to support the self-management of medications in PD.

Higher treatment burden levels are associated with lower levels of self-management adherence(97, 115). Therefore, healthcare professionals have an important role in supporting PwP and caregivers with self-management by empowering individuals to self-manage through holistic and person-centred care, increasing their motivations and maximising capability to self-management, including caregivers in self-management, and addressing issues within their social and healthcare context(379). However, there are currently insufficient high quality RCTs that have demonstrated the effectiveness of self-management interventions in PD(380). Active engagement of PwP and caregivers with the vast amount of support and resources provided by Parkinson's UK could be a solution that can support self-management strategies and increase aspects of patient capacity. Healthcare professionals should signpost all PwP and caregivers from initial diagnosis of PD to Parkinson's UK so that they are aware of its existence and when or how they can access the support if they so wish to do so, understanding that not everyone may want to engage at different stages of disease.

Capacity coaching is a novel strategy that draws on the Cumulative Complexity Model and Minimally Disruptive Medicine to develop the capacity of patients with multimorbidity to manage the complex interactions with their daily lives, health, and healthcare(381). The ICAN Discussion Aid was developed as a starting point to determine how, and to what extent treatment burden affects the patient's life by drawing on the five factors of patient capacity identified by the Theory of Patient Capacity (Section 1.7, page 53): 1) biography, 2) resources, 3) environment, 4) accomplishing work, and 5) social. This tool was designed to be used by capacity coaches, who may be healthcare professionals or trained peers to co-create strategies with patients that could reduce treatment burden by bolstering existing sources of capacity and cultivating new capacity to adapt to life with chronic illness. Capacity coaching was shown to be feasible within a primary care setting in the USA and could help support PwP and caregivers in managing treatment burden, although further research is required(382). Reinforcement and encouragement from healthcare professionals to help PwP and caregivers recognise and draw on their personal aspects of capacity could potentially support their self-management when living with PD.

7.6.2 Individual provider level

Healthcare professionals could implement changes in their clinical practice that may improve experiences of treatment burden and capacity for PwP and caregivers(383). However, most healthcare professionals remain unaware of the concept of treatment burden and capacity, and do not tend to address these aspects in the clinical setting(96, 98, 384). Awareness amongst healthcare professionals of these concepts and their potential negative implications on medication adherence and health outcomes is perhaps the first step towards ensuring treatment recommendations that do not overwhelm PwP and caregivers(323). Specific simulated role-play training exercises involving PwP and caregivers for healthcare professionals working with PwP that aim to improve communication, interpersonal skills, and set clear expectations can improve interactions between patients and healthcare professionals. This could enhance interactions and relationships between healthcare providers, PwP and caregivers. Positive experiences with healthcare professionals can help PwP and caregivers understand and accept the nuances of living with PD, and what can be done to manage this. Shared-decision making with PwP and caregivers and prioritising delivery of personalised care based on an individual needs, wishes, and social context using an MDT approach is important to ensure that they are not overburdened with the work of managing PD.

Addressing polypharmacy through regular structured medication reviews, simplification of medication regimes, and ensuring support for PD medication changes could support the

medication burden in PD. Developing close MDT working between PD specialists, GPs and pharmacists and utilising deprescribing tools can reduce the medication burden for PwP and caregivers. Every contact with healthcare professionals should be taken as an opportunity to signpost PwP and caregivers to the appropriate information, resources and services available to them such as Parkinson's UK. Utilising social prescribing link workers within primary care where available is key to increasing the social network support for PwP and caregivers. Healthcare professionals should ensure that health literacy is addressed by using simple, balanced language aided by pictures or videos if required and focusing on what is important for PwP and caregivers. Another way that could be a start towards addressing treatment burden in a clinical setting is by asking the patient a question proposed by Linzer et al: "*What challenges do you experience in your treatment and self-management?"*(371).

7.6.3 System level

This study has also highlighted important changes that could be implemented at a system level to improve treatment burden experienced in PD. Firstly, policy change to increase education and awareness regarding the complex needs of PD and the importance of addressing treatment burden and capacity issues amongst healthcare professionals could be beneficial. This could lead to changes at individual provider level as described in the previous section. The NICE guidelines for multimorbidity in 2016 recommended that treatment burden is established with an individualised management plan(90). This is perhaps an indicator of health policy change within the NHS towards better coordinated and personalised care that minimises treatment burden. Furthermore, this could improve access to services for PwP and caregivers, particularly the need for an MDT approach when managing the progressive disease. Secondly, increasing the flexibility of appointment structures (length between appointments, length of appointment, mode of appointment) based on patient needs and preferences could also reduce treatment burden, although this needs to be carefully balanced against the potential negative impact on access due to increasing demands with limited healthcare capacity. Moreover, treatment burden experienced due to fragmented and poorly coordinated care in PD could be improved by breaking down barriers between services through the development of integrated models of care, single-point access to care, wider use of shared online medical records, and availability of FP10 prescriptions for use by PD specialists. Embracing the role of technology in improving care coordination, communication between services, and access to appointments through telemedicine could help reduce the treatment burden in PD. Improving health literacy at a system level by ensuring good provision of information and communication about the diagnosis of PD,

treatments, prognosis, lifestyle activities and the use of devices to help daily management could enhance capacity of PwP and caregivers.

A recent systematic review in 2022 identified 18 RCTs that investigated the impact of system-level interventions on at least one domain of treatment burden amongst adults with multimorbidity(385). The review reported that seven domains of treatment burden were identified, with the most common outcomes relating to the impact of health-related QoL and functional status. There was heterogeneity in the outcome measurement tools used across the included articles. Only one high-quality multi-centre RCT by Salisbury et al measured the effect of primary care service changes across multiple providers in the UK for patients with multimorbidity on treatment burden levels using the MTBQ(325). However, the RCT found no significant improvement in treatment burden levels. Therefore, further research is needed to determine the effectiveness of system-level interventions on treatment burden levels. Utilising the principles of "Minimally Disruptive Medicine" when implementing system-level changes could help the development of healthcare structures that deliver effective and personalised care that minimises treatment burden and maximises capacity in PD(386).

7.6.4 Prioritised Recommendations for Change

Whilst there was a lack of prioritisation of recommendations in the focus group discussions of this study, the recommendations for change can be prioritised building on evidence from the current literature and based on my reflections and experiences of working as a clinician in the NHS for nearly ten years. Some changes could be implemented into current clinical practice to improve the experiences of PwP and caregivers without the need for additional resources. For instance, encouraging the use and signposting PwP and caregivers to readily available and accessible resources for practical support with prescriptions or medications as well as utilising the role of social prescribing link workers could enhance their capacity to manage treatment burden. Individual providers can employ clear, open communication channels and shared decision-making with a focus towards delivering personalised care for PwP and caregivers by specifically addressing issues that contribute to treatment burden such as polypharmacy, access to appointments and understanding of information regarding PD. Increasing the availability of small group education sessions by healthcare professionals for PwP and caregivers at various stages of PD could also reduce treatment burden and enhance capacity by providing wider social network support.

Other recommendations that should be prioritised include the development of multidisciplinary team working within PD services given the complex needs of PwP and caregivers with multimorbidity and frailty to allow for personalised, proactive and coordinated care(34). Although changes brought on by the NHS Long Term Plan with investments into integrated care systems, increasing access to shared online medical records and better use of digital technology can take time to be fully implemented in practice, this should be embraced at the system level with a particular focus on identifying and reducing treatment burden in PD(350). Increasing education and awareness about treatment burden and capacity through ongoing dissemination of The PD Life Study findings to key stakeholders will positively contribute towards improving the experiences of PwP and caregivers.

7.7 Challenges and Limitations of The PD Life Study

I have previously described the strength and limitations of each Work Package of the PD Life Study within the discussion sections of Chapters 3-6. On further reflection, there are also challenges and limitations of the overall study that must be acknowledged. Firstly, Eton's framework of treatment burden was used as the framework for the study which may have influenced data collection and data analysis. Whilst this could be seen as a limitation, this impact was minimised as I recognised the constraints of using Eton's framework when conducting the systematic review and ensured that I kept an open mind whilst coding so that data did not 'fit' into the framework. This allowed me to identify the interlinked themes of treatment burden and capacity beyond Eton's framework, including the impact of PD symptoms and severity. Furthermore, the order of the Work Packages meant that by conducting the qualitative interviews before the national surveys, I was not able to obtain an in-depth understanding or compare the experiences of PwP and caregivers who reported high or low treatment burden levels. However, as this was an explorative and iterative study, findings from the interviews informed the development of the surveys which were then validated at a wider level and should be seen as a strength. Thirdly, the findings of this study may have been influenced by the COVID-19 pandemic. The interviews were conducted in June 2021, whilst the surveys were conducted from September 2021 to January 2022. The experiences of PwP and caregivers may not reflect current healthcare system structures that may have changed as a result of the pandemic.

Finally, the study findings may not be generalisable due to the lack of participant diversity although the national survey attempted to mitigate this limitation. Whilst there was a wide geographical spread, I anticipated more ethnic diversity than what was achieved within the survey

participant sample. Participants were also well educated and digitally active, which may be a limitation of using Parkinson's UK online research networks for recruitment. Face-to-face recruitment via local PD clinics tried to reduce this. It may also be that PwP and caregivers who were most burdened with managing PD did not participate in this study due to the constraints on time. Recruitment of under-represented groups should be prioritised with specific target populations such as those from ethnic minority backgrounds, in employment, with less financial and family support or with lower health or digital literacy. Widening participants within the PPI research group through Parkinson's UK, local PD support groups and research networks is key to increasing the diversity of research participants and addressing the potential causes of health inequality. This can help researchers build relationships with under-represented communities, understand barriers or facilitators to recruitment in research taking into account cultural or language differences and help with the development of strategies to recruit participants from these backgrounds. For example, increasing the availability of translated recruitment materials, conducting interviews in their native language, in the evenings or at weekends, and active face-to-face recruitment and data survey collection not only from PD clinics but also at local community events could overcome this limitation and support engagement of participants from all sociodemographic background in future studies.

7.8 Considerations for Future Research

This study has identified the need for further research (see Table 47). Further exploration of the relationship between symptoms and treatment burden levels in PD, caregiver burden and treatment burden levels for both PwP and caregivers, changes in treatment burden levels as PD progresses, ways to identify those at risk of higher treatment burden within a clinical setting, and the impact of intervention at individual and system level in PD is required.

Table 47: Future research questions

Need for future research	Future research questions
Exploring treatment burden and capacity	• What is the relationship between symptom burden and treatment burden in PD? • What is the relationship between caregiver burden and treatment burden in PD?
Experiences of treatment burden and capacity at different stages of PD	• Do treatment burden and capacity change as PD progresses?

Identifying treatment burden and capacity in a clinical setting	• Can we identify PwP at risk of high treatment burden in a clinical setting? • Can we identify which aspect of treatment burden is most burdensome for PwP and caregivers in a clinical setting? • Can we develop a treatment burden measure specific to PD that takes into account the key clinical indicators such as frailty, PD severity and PD NMS? • Can we quantify patient and/or caregiver capacity in PD?
Impact of intervention	• What is the impact of different interventions (whether individual or system level) on treatment burden levels in PD?

7.9 Thesis Conclusion

This thesis has for the first time explored the extent to which PwP and their caregivers experience treatment burden, the impact of frailty and multimorbidity, and described the key modifiable factors that impact on treatment burden and capacity of PwP and caregivers. The key issues of treatment burden and capacity in PD identified in this research relate to organising healthcare appointments and interactions with healthcare professionals, managing prescriptions and multiple medications, satisfactory information provision, and making lifestyle changes. These issues are closely interlinked with each other and can be affected by PD severity, PD symptoms, frailty and the presence of multimorbidity. Using the MTBQ, nearly one-fifth of PwP and half of caregivers in this study reported high treatment burden levels. There are changes that could be implemented by PwP and caregivers, individual providers, and at the system-level to modify these factors to reduce treatment burden or enhance capacity. This could prevent poor outcomes in PD, although future research is required.

Appendix A Ethical Approval

Ymchwil Iechyd a Gofal Cymru
Health and Care Research Wales

NHS
Health Research Authority

Professor Helen Roberts
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Southampton General Hospital
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Email: approvals@hra.nhs.uk
HCRW.approvals@wales.nhs.uk

29 March 2021

Dear Professor Roberts

HRA and Health and Care Research Wales (HCRW) Approval Letter

Study title:	**Exploring the treatment burden and capacity of people with Parkinson's and their caregivers**
IRAS project ID:	**277464**
REC reference:	**21/WM/0058**
Sponsor	**University of Southampton**

I am pleased to confirm that HRA and Health and Care Research Wales (HCRW) Approval has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications received. You should not expect to receive anything further relating to this application.

Please now work with participating NHS organisations to confirm capacity and capability, in line with the instructions provided in the "Information to support study set up" section towards the end of this letter.

How should I work with participating NHS/HSC organisations in Northern Ireland and Scotland?
HRA and HCRW Approval does not apply to NHS/HSC organisations within Northern Ireland and Scotland.

If you indicated in your IRAS form that you do have participating organisations in either of these devolved administrations, the final document set and the study wide governance report (including this letter) have been sent to the coordinating centre of each participating nation. The relevant national coordinating function/s will contact you as appropriate.

Please see IRAS Help for information on working with NHS/HSC organisations in Northern Ireland and Scotland.

How should I work with participating non-NHS organisations?
HRA and HCRW Approval does not apply to non-NHS organisations. You should work with your non-NHS organisations to obtain local agreement in accordance with their procedures.

What are my notification responsibilities during the study?

The standard conditions document "*After Ethical Review – guidance for sponsors and investigators*", issued with your REC favourable opinion, gives detailed guidance on reporting expectations for studies, including:

- Registration of research
- Notifying amendments
- Notifying the end of the study

The HRA website also provides guidance on these topics, and is updated in the light of changes in reporting expectations or procedures.

Who should I contact for further information?
Please do not hesitate to contact me for assistance with this application. My contact details are below.

Your IRAS project ID is **277464**. Please quote this on all correspondence.

Yours sincerely,
Amber Ecclestone

Approvals Specialist

Email: approvals@hra.nhs.uk

Copy to: *Dr Alison Knight*

List of Documents

The final document set assessed and approved by HRA and HCRW Approval is listed below.

Document	*Version*	*Date*
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [University of Southampton Insurance letter]		
GP/consultant information sheets or letters [GP letter v1]	1	17 March 2021
Interview schedules or topic guides for participants [Interview schedule (Caregivers) v1]	1	12 January 2021
Interview schedules or topic guides for participants [Interview Schedule (PwP) v1]	1	12 January 2021
Interview schedules or topic guides for participants [Focus Group Guide v1]	1	12 January 2021
IRAS Application Form [IRAS_Form_04022021]		04 February 2021
Letter from funder [NIHR ARC Funding letter]		
Letter from sponsor [University of Southampton Sponsor letter]		
Letters of invitation to participant [PD Life Study Invitation letter v2]	2	17 March 2021
Letters of invitation to participant [Study Results Invitation Form v1]	1	12 January 2021
Non-validated questionnaire [Survey (Caregivers) v2]	2	17 March 2021
Non-validated questionnaire [Survey (PwP) v2]	2	17 March 2021
Organisation Information Document [Organisation Information Document v1]	1	12 January 2021
Other [Letter of Support from Parkinson's UK]		
Other [Response to Ethics Committee]		17 March 2021
Other [Parkinson's UK study recruitment response]		16 March 2021
Participant consent form [Interview Consent Form v2]	2	17 March 2021
Participant consent form [Focus Group Consent Form v2]	2	17 March 2021
Participant information sheet (PIS) [PIS Interview (Caregivers) v2]	2	17 March 2021
Participant information sheet (PIS) [PIS Interview (PwP) v2]	2	17 March 2021
Participant information sheet (PIS) [PIS Survey (Caregivers) v2]	2	17 March 2021
Participant information sheet (PIS) [PIS Survey (PwP) v2]	2	17 March 2021
Participant information sheet (PIS) [PIS Focus Group v2]	2	17 March 2021
Research protocol or project proposal [PD Life Study Protocol v2]	2	17 March 2021
Schedule of Events or SoECAT		
Summary CV for Chief Investigator (CI) [Prof H Roberts CV]		
Summary CV for student [Dr QY Tan CV]		
Summary CV for supervisor (student research) [Dr S Fraser CV]		
Summary CV for supervisor (student research) [Dr K Ibrahim CV]		
Summary, synopsis or diagram (flowchart) of protocol in non technical language [PD Life Study Flowchart v1]	1	12 January 2021

IRAS project ID	277464

Information to support study set up

The below provides all parties with information to support the arranging and confirming of capacity and capability with participating NHS organisations in England and Wales. This is intended to be an accurate reflection of the study at the time of issue of this letter.

Types of participating NHS organisation	Expectations related to confirmation of capacity and capability	Agreement to be used	Funding arrangements	Oversight expectations	HR Good Practice Resource Pack expectations
All sites will perform the same research activities therefore there is only one site type.	Research activities should not commence at participating NHS organisations in England or Wales prior to their formal confirmation of capacity and capability to deliver the study.	Organisation Information Document acts as agreement.	No funding is being provided to sites by the sponsor.	A Principal Investigator should be appointed at study sites	No Honorary Research Contracts, Letters of Access or pre-engagement checks are expected for local staff employed by the participating NHS organisations. Where arrangements are not already in place, research staff not employed by the NHS host organisation undertaking any of the research activities listed in the research application would be expected to obtain a Letter of Access based on standard DBS checks and occupational health clearance.

Other information to aid study set-up and delivery

This details any other information that may be helpful to sponsors and participating NHS organisations in England and Wales in study set-up.

The applicant has indicated that they do not intend to apply for inclusion on the NIHR CRN Portfolio.

Appendix B 13-item MTBQ

THE EFFORT OF LOOKING AFTER YOUR HEALTH

We are interested in finding out about the effort you have to make to look after your health and how this impacts on your day-to-day life.
Please tell us how much difficulty you have with the following:
(Please tick the box that most applies to you)

	Extremely Difficult	Very Difficult	Quite Difficult	A little Difficult	Not Difficult	Does not apply
1. Taking lots of medications	☐5	☐4	☐3	☐2	☐1	☐0
2. Remembering how and when to take medication	☐5	☐4	☐3	☐2	☐1	☐0
3. Paying for prescriptions, over the counter medication or equipment	☐5	☐4	☐3	☐2	☐1	☐0
4. Collecting prescription medication	☐5	☐4	☐3	☐2	☐1	☐0
5. Monitoring your medical conditions (e.g. checking your blood pressure or blood sugar, monitoring your symptoms etc.)	☐5	☐4	☐3	☐2	☐1	☐0
6. Arranging appointments with health professionals	☐5	☐4	☐3	☐2	☐1	☐0
7. Seeing lots of different health professionals	☐5	☐4	☐3	☐2	☐1	☐0
8. Attending appointments with health professionals (e.g. getting time off work, arranging transport etc.)	☐5	☐4	☐3	☐2	☐1	☐0
9. Getting health care in the evenings and at weekends	☐5	☐4	☐3	☐2	☐1	☐0
10. Getting help from community services (e.g. physiotherapy, district nurses etc.)	☐5	☐4	☐3	☐2	☐1	☐0
11. Obtaining clear and up-to-date information about your condition	☐5	☐4	☐3	☐2	☐1	☐0
12. Making recommended lifestyle changes (e.g. diet and exercise etc.)	☐5	☐4	☐3	☐2	☐1	☐0
13. Having to rely on help from family and friends	☐5	☐4	☐3	☐2	☐1	☐0

Multimorbidity Treatment Burden Questionnaire (MTBQ)

Appendix C Caregiver MTBQ

Name..... Date.....

Looking after the health of the person you care for.
We are interested in finding out about the effort you have to make in order to look after the health of the person you care for, and how this impacts on your day-to-day life.

Please tell us how much difficulty you have with helping the person you care for with the following: (Please tick the box that most applies to you.)

	Not difficult	A little difficult	Quite difficult	Very difficult	Extremely difficult	Does not apply
1. Taking lots of medications	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
2. Remembering how and when they need to take their medication	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
3. Paying for their prescriptions, over the counter medication or equipment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
4. Collecting their prescription medication	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
5. Monitoring their medical conditions (e.g. Checking their blood sugar, monitoring symptoms etc)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
6. Arranging their appointments with health professionals	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
7. Seeing lots of different health professionals	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
8. Attending appointments with health professionals (eg. getting time off work, arranging transport etc)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
9. Getting health care for them in the evenings and at weekends	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
10. Getting them help from community services (e.g. physiotherapy, district nurses etc)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
11. Obtaining up-to-date information about their medical conditions	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
12. Making recommended changes to their lifestyle (e.g. Diet, exercise etc)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0

Please tell us how difficult you have found the following:
(please tick the box that most applies)

	Not difficult	A little difficult	Quite difficult	Very difficult	Extremely difficult	Does not apply
13. Having to rely on help from family and friends	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
14. Arranging respite care for the person you care for	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
15. The financial impact of being a carer (e.g. having to give up work, relying on benefits etc)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0
16 Adjusting your own lifestyle so that you can look after the person you care for	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 0

2

Appendix D Systematic review search strategy

D.1 MEDLINE

1 Parkinson*.mp.

2 caregiv*.mp.

3 care giv*.mp

4 carer*.mp.

5 care partner*.mp.

6 carepartner*.mp.

7 (treatment* adj3 burden*).mp.

8 (treatment* adj3 work*).mp.

9 (treatment* adj3 fatigue*).mp.

10 (treatment* adj3 impact*).mp.

11 (health* adj3 burden*).mp.

12 (health* adj3 work*).mp.

13 (health* adj3 impact*).mp.

14 (therap* adj3 burden*).mp.

15 (therap* adj3 work*).mp.

16 (manag* adj1 health*).mp

17 (look* adj2 health).mp

18 burden*.mp

19 workload.mp.

20 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19

21 1 and 20

22 qualitative research/

23 qualitative.mp.

24 interview*.mp

25 focus group*.mp.

26 questionnaire*.mp.

27 survey*.mp.

28 observation*.mp.

29 narrative*.mp.

30 field stud*.mp

31 ethnograph*.mp.

32 experience*.mp.

33 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32

34 21 and 33

35 limit 34 to yr="2006 -Current"

D.2 Embase

1 Parkinson*.mp.

2 caregiv*.mp.

3 care giv*.mp

4 carer*.mp.

5 care partner*.mp.

6 carepartner*.mp.

7 (treatment* adj3 burden*).mp.

8 (treatment* adj3 work*).mp.

9 (treatment* adj3 fatigue*).mp.

10 (treatment* adj3 impact*).mp.

11 (health* adj3 burden*).mp.

12 (health* adj3 work*).mp.

13 (health* adj3 impact*).mp.

14 (therap* adj3 burden*).mp.

15 (therap* adj3 work*).mp.

16 (manag* adj1 health*).mp

17 (look* adj2 health).mp

18 burden*.mp

19 workload.mp.

20 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19

21 1 and 20

22 qualitative research/

23 qualitative.mp.

24 interview*.mp

25 focus group*.mp.

26 questionnaire*.mp.

27 survey*.mp.

28 observation*.mp.

29 narrative*.mp.

30 field stud*.mp

31 ethnograph*.mp.

32 experience*.mp.

33 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32

34 21 and 33

35 limit 34 to yr="2006 -Current"

36 limit 35 to conference abstracts

37 35 NOT 36

D.3 CINAHL

1 Parkinson*

2 caregiv*

3 "care giv*"

4 carer*

5 "care partner*"

6 carepartner*

7 "treatment* N3 burden*"

8 "treatment N3 work*"

9 "treatment* N3 fatigue*"

10 "treatment* N3 impact*"

11 "health* N3 burden*"

12 "health* N3 work*"

13 "health* N3 impact*"

14 "therap* N3 burden*"

15 "therap* N3 work*"

16 "manag* N1 health*"

17 "look* N2 health"

18 burden*

19 workload

20 S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19

21 S1 AND S20

22 DE "Qualitative Methods"

23 qualitative*

24 interview*

25 "focus group*"

26 questionnaire*

27 survey*

28 observation*

29 narrative*

30 "field stud*"

31 ethnograph*

32 experience*

33 S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32

34 S21 AND S33

35 S21 AND S33 Published Date: 20060101-20201231

D.4 PsychInfo

1 Parkinson*

2 caregiv*

3 "care giv*"

4 carer*

5 "care partner*"

6 carepartner*

7 "treatment* N3 burden*"

8 "treatment N3 work*"

9 "treatment* N3 fatigue*"

10 "treatment* N3 impact*"

11 "health* N3 burden*"

12 "health* N3 work*"

13 "health* N3 impact*"

14 "therap* N3 burden*"

15 "therap* N3 work*"

16 "manag* N1 health*"

17 "look* N2 health"

18 burden*

19 workload

20 S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19

21 S1 AND S20

22 DE "Qualitative Methods"

23 qualitative*

24 interview*

25 "focus group*"
26 questionnaire*
27 survey*
28 observation*
29 narrative*
30 "field stud*"
31 ethnograph*
32 experience*
33 S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32
34 S21 AND S33
35 S21 AND S33 Publication Year 2006-2020

D.5 Scopus

((TITLE-ABS-KEY(Parkinson*)) AND ((TITLE-ABS-KEY(caregiv* OR {care give*} OR carer* OR {care partner*} OR carepartner*)) OR (TITLE-ABS-KEY(treatment* W/3 (burden* OR work* OR fatigue* OR impact*))) OR (TITLE-ABS-KEY(health* W/3 (burden* OR work* OR impact*))) OR (TITLE-ABS-KEY(therap* W/3 (burden* OR work*))) OR (TITLE-ABS-KEY(manag* W/1 health*)) OR (TITLE-ABS-KEY(look* W/2 health*)) OR (TITLE-ABS-KEY(burden* OR workload)))) AND (TITLE-ABS-KEY(qualitative* OR interview* OR (focus group*) OR questionnaire* OR survey* OR observation* OR narrative* OR (field stud*) OR ethnograph* OR experience*)) AND (PUBYEAR > 2005)

Appendix E Data extraction template

ARTICLE DETAILS		
Authors		
Year of publication		
Title		
Country of origin		
STUDY DETAILS		
Type and method of study		
Setting		
Aim(s) of study		
Demographic data	Number of participants in total	
	Number of PwP	
	Number of PwP caregivers	
	Caregiver relationship	
	Gender	
	Age	
	Severity of PD	
RESULTS		
Inclusion criteria	**Experiences of PwP and/or caregivers related to:-** • Any treatment/ management/ tasks/ services related to looking after their health or illness that is difficult, unpleasant or causes worry • Challenges/stressors that exacerbate felt burden • Impacts of burden *E.g. taking medications, obtaining prescriptions, attending appointments, navigating the healthcare system, having to seek information regarding health or social care, monitoring health, lifestyle changes etc.*	

Exclusion Criteria	Experiences of PwP and/or caregivers related to:-
	• Burden of illness or symptom burden specifically any impact of mental or physical symptoms or disability due to PD such as changes to relationships, psychological impact, stigma, change in role/identity • Perceptions of illness • Comments on treatments or services that do not explore the treatment burden • Idea or expectations of what treatment or services should be that do not related to personal experiences that have caused treatment burden • Caregiver burden • The strain from completing or helping with activities of daily living such as washing, cleaning, cooking etc.

Appendix F Summary of included articles

Author(s), Year and Country	Number of participants and gender	Age of PwP and/or caregivers (years)	Severity of Parkinson's Disease	Living arrangements of PwP	Qualitative methods	Primary aim
Abendroth et al 2012 (USA) (259)	20 Caregivers (3M,17F)	N/A	Length of diagnosis range = 3-23	Home and care home	Interviews	To understand how caregivers make decisions to institutionalize a relative with PD
Armitage et al 2009 (UK) (276)	24 PwP 51 Caregivers (Gender N/A)	N/A	N/A	RH or NH	Interviews	To explore the care of persons with PD who are care home residents
Barken 2014 (Canada) (290)	8 Caregivers (4M, 4F)	>65	All had physical impairment due to PD	N/A	Observations at support meetings and interviews	To examine the biographical trajectories of people caring for a spouse with PD
Berger et al 2019 (USA) (286)	20 Caregivers (8M,12F)	Caregivers mean = 68 PwP mean = 68	H&Y stages 2 to 4; Mean length of diagnosis = 9	N/A	Interviews	To explore the concept of social self-management of spousal caregivers of people with PD
Boersma et al 2017 (USA) (271)	11 Caregivers (2M,9F)	Caregivers mean = 65 PwP mean = 65	H&Y stages 2 to 4	N/A	Interviews and 1 focus group	To elicit PD caregiver needs, salient concerns, and preferences for care using a palliative care framework
Buetow et al 2010 (New Zealand) (274)	13 PwP and 7 proxies (14M,6F)	14 PwP >65 6 PwP <65	Mean length of diagnosis = 11	N/A	Interviews	To explore experience and factors that contribute to errors around medication timing for PD

Dauwerse et al 2014 (Netherlands) (283)	Interviews: 27 PwP and Caregivers (15M,12F) Focus groups: 30 PwP (20M,10F)	Interviews: 5 PwP <56 22 PwP ≥56 Focus groups: 11 PwP <56 19 PwP ≥ 56	Length of diagnosis Interviews: 7 PwP ≤3 20 PwP >3 Focus groups: 11 PwP ≤3 19 PwP >3	Interviews: Home and NH Focus groups: Home	Interviews and focus groups	To give an overview of quality of life from the perspective of patients with PD
Dekawaty et al 2019 (Indonesia) (277)	5 Caregivers (Gender N/A)	Range = 31-67	Length of diagnosis range = 2-7	N/A	Interviews	To explore family members' experiences in caring for relatives with PD
Den Oudsten et al 2011 (International – 7 countries) (265)	38 PwP 8 Caregivers (Gender N/A)	PwP means range = 54.4 – 74.3 (7 groups) Caregivers means = 52.0 and 56.8 (2 groups)	N/A	Home	Focus groups	To add qualitative knowledge about PD and quality of life
Drey et al 2012 (UK) (269)	15 PwP (9M,6F)	Range = 44-74	Length of diagnosis range = <1-17	Home	Interviews	To provide descriptions of adherence and non-adherence to medication by people with PD
Duncan et al 2011 (Australia) (270)	22 PwP 8 Caregivers (Gender N/A)	PwP means > 60 (4 focus groups) Caregivers N/A	N/A	N/A	Focus groups	To examine the dynamics of healthcare delivery to PwP and their caregivers in New South Wales

Fox et al 2017 (Ireland) (280)	19 PwP (13M,6F) 12 Caregivers (1M,11F)	PwP mean = 67.9 Caregivers mean = 68.2	PwP mean length of diagnosis = 7.25 Caregivers mean length of diagnosis = 5.4	Home	Interviews	To explore the palliative care and related issues affecting people with PD and their families
Giles and Miyasaki 2009 (Canada) (279)	3 PwP (1M,2F) 4 Caregivers (1M,3F)	PwP range = 71-77 Caregivers range = 36-75	H&Y stages 3 to 5	N/A	Interviews	To understand the healthcare experiences and needs of persons living with palliative stage PD and family members
Haahr et al 2010 (Denmark) (260)	9 PwP (6M,3F)	Mean = 61	Mean length of diagnosis = 15	N/A	Interviews	To explore the experiences of patients with advanced PD during the first year of DBS
Haahr et al 2011 (Denmark) (261)	11 PwP (8M,3F)	Mean = 60	Mean length of diagnosis = 15	Home	Interviews	To explore patients' lifeworld with advanced PD prior to DBS and expectations following DBS
Habermann et al 2017 (USA) (268)	14 PwP (7M,7F) 14 Caregivers (7F,7M)	PwP mean = 73.3 Spouse mean = 72.1	Mean length of diagnosis = 12.18; Mobility dependent on assistive devices	Home at baseline, 3 PwP in care home at 3 months	Interviews	To describe the needs, concerns and preferences of couples with advanced PD as they plan the care needed for the future
Hasson et al 2010 (UK) (282)	15 Caregivers (4M,11F)	>55	N/A	PwP that have recently deceased	Interviews	To explore former carers' lived experiences of palliative and end-of-life care in PD

Hounsgaard et al 2011 (Denmark) (262)	10 Caregivers (10F)	Mean = 65.8	Mean length of diagnosis = 3.7	Home	Interviews	To throw light on the lived experiences of female partners of patients with PD living at home
Hudson et al 2006 (Australia) (287)	8 PwP (4M,4F) 21 Caregivers (6M,15F)	PwP range = 40 to >80 Caregivers range = 41-80	Median length of diagnosis = 11	N/A	Interviews	To describe the experiences of PD and consider the relevance of palliative care for this population
Hurt et al 2017 (UK) (267)	18 Caregivers (8M,10F)	Mean = 65.4	Mean length of diagnosis = 10.3	N/A	Interviews	To investigate the nature of illness uncertainty in the carers of patients with PD
Mclaughlin et al 2010 (UK) (133)	26 Caregivers (9M,17F)	21 Caregivers (81%) >55	Length of caregiving = 2-20	Home	Interviews	To explore the experience of informal caregivers of people with PD
Mclennon et al 2010 (USA) (293)	2 PD Caregivers (Gender N/A)	All participants mean = 79.5	Mean H&Y = 3.25	N/A	Interviews	To identify common themes from caregivers who institutionalize their relative with Alzheimer's or PD
Mshana et al 2011 (Tanzania) (291)	Interviews: 28 PwP and 28 Caregivers (All participants = 32M,30F) Focus Groups: 50 participants (unclear role) (24M,26F)	PwP range = 45-94	N/A	Home	Interviews and focus groups	To investigate the experience and treatment seeking behaviours of PD sufferers and their caregivers together with community understandings of Parkinson's disease in a rural part of Tanzania

Nunes et al 2019 (Brazil) (292)	20 Caregivers (4M,16F)	Range = 37-85	N/A	Home	Interviews	To investigate the facilitator and inhibitory factors in elderly caregivers with PD
Pateraki 2019 (Greece) (288)	19 PwP 13 Caregivers (Gender N/A)	PwP range = 46-72	N/A	Home	Interviews	To explore patients' experience with DBS, with a focus on the temporal dimension
Rastgardani et al 2019 (USA) (266)	20 Caregivers (11F, 9M)	PwP mean = 65.1	Mean length of diagnoses = 7.8	N/A	Interviews (secondary data analysis)	To explore how caregivers of PwP are engaged by clinicians in discussions of "off" periods
Read et al 2019 (UK) (132)	10 PwP (7M, 3F)	Mean = 77	H&Y stage 4 or 5; Mean length of diagnosis = 18	Home and NH	Interviews	To explore experiences of service use and unmet care needs of late stage Parkinson's
Roland et al 2010 (Canada) (275)	5 Caregivers (5F)	Range = 49-71	Length of diagnosis range = 2-14	N/A	Repertory grid methodology	To determine the aspects of care that are most salient to caregiver burden and in PwP
Shaw et al 2017 (UK) (263)	12 PwP (7M, 5F)	Male range = 60-86 Female range = 51-70	Length of diagnosis range = 11 months to 24 years	Home	Interviews	To investigate the current ethical issues in relation to recognizing and managing PD from the patients' perspective
Shin et al 2015 (USA) (264)	16 PwP (11M, 5F) 5 Caregivers (2M, 3F)	PwP mean = 68.1 Caregivers mean = 73.2	Mean length of diagnosis = 5.4	Home	Interviews	To describe challenges in medication adherence and identify strategies to facilitate adherence in people with PD
Shin et al 2016 (USA) (294)	16 PwP (11M, 5F) 5 Caregivers (2M,3F)	PwP mean = 68.1 Caregivers mean = 73.2	Mean length of diagnosis = 5.4	Home	Interviews	To understand experiences of people with PD to initiate medication therapy for PD

Smith and Shaw 2017 (UK) (284)	4 PwP (2M,2F) 5 Caregivers (2M,3F)	PwP range = 67-75 Caregivers range = 67-85	Length of diagnosis range = 2 to 21	Home	Interviews	To investigate family members' lived experience of PD aiming to investigate opportunities for well-being
Soleimani et al 2016 (Iran) (295)	17 PwP (10M, 7F)	Range = 60-90	H&Y stages 1 to 5; Length of diagnosis range = 1 to 21	Home	Interviews	To explore the primary concerns and perceptions of patients living with PD
Tan et al 2012 (Singapore) (285)	21 Caregivers (4M, 17F)	Caregivers range = 31 to >71 PwP range = 41 to >71	H&Y stages 1-5	Home	Interviews	To conduct an in-depth qualitative examination of the experiences of Singaporean people caring for those with PD
Van der Eijk et al 2011 (Netherlands) (281)	40 PwP (30M,10F) 20 Caregivers (5M,15F)	PwP mean = 61.9 Caregivers mean = 63.0	H&Y stage 1-3; Mean length of diagnosis = 6	Home	Focus groups	To explore the experiences of PD patients and their informal caregivers concerning received healthcare
Van Rumund et al 2014 (Netherlands) (273)	15 PwP 15 Caregivers (20F,10M)	Mean = 77.1	H&Y stages 3-5; Mean length of diagnosis = 11.4	NH	Interviews	To analyse the quality of PD care in NHs
Walga 2019 (Ethiopia) (289)	20 Caregivers (7M,13F)	Caregivers range = 14-66 PwP range = 50-89	Mean length of diagnosis = 5	N/A	Qualitative survey questionnaire	To explore the lived experiences and perspectives of PD patients' caregivers
Williams and Keady 2008 (UK) (272)	26 PwP and Caregivers (Gender N/A)	PwP range = 61-89	Late-stage disease using H&Y	Home	Interviews	To examine the experiences of older people with late-stage PD and the transitions experienced by patients and their families

Williamson et al 2008 (UK) (278)	10 Caregivers (10F)	Mean = 70	Mean length of diagnosis = 11	Home	Interviews	To present caregivers' experience of living with a partner with PD and psychotic symptoms and coping strategies

F, Female; H&Y, Hoehn and Yahr; M, Male; PD, Parkinson's Disease; PwP, People with Parkinson's; UK, United Kingdom; USA, United States of America

Appendix G Critical Appraisal Skills Programme scores

Study first author last name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Total
Abendroth	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	8
Armitage	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	8
Barken	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	9
Berger	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	8
Boersma	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	9
Buetow	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	8
Dauwerse	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Dekawaty	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	No	6
Den Oudsten	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	7
Drey	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Duncan	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	6
Fox	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	9
Giles	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Haahr (2010)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	9
Haahr (2011)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	9
Habermann	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	9
Hasson	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	9
Hounsgaard	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	9
Hudson	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	9
Hurt	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Mclaughlin	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	8

Mclennon	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	7
Mshana	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	7
Nunes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	8
Pateraki	Yes	Yes	Yes	No	Yes	No	No	No	No	No	4
Rastgardani	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	8
Read	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10
Roland	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	No	6
Shaw	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	7
Shin (2015)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	9
Shin (2016)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	9
Smith	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	7
Soleimani	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	8
Tan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	8
Van der Eijk	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	8
Van Rumund	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	8
Walga	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	5
Williams	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	9
Williamson	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10

Appendix H Published systematic review article

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Research Report

The Experiences of Treatment Burden in People with Parkinson's Disease and Their Caregivers: A Systematic Review of Qualitative Studies

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Abstract.
Background: High treatment burden is associated with poor adherence, wasted resources, poor quality of life and poor health outcomes. Identifying factors that impact treatment burden in Parkinson's disease can offer insights into strategies to mitigate them.
Objective: To explore the experiences of treatment burden among people with Parkinson's disease (PwP) and their caregivers.
Methods: A systematic review of studies published from year 2006 was conducted. Qualitative and mixed-method studies with a qualitative component that relate to usual care in Parkinson's disease were included. Quantitative studies and grey literature were excluded. Data synthesis was conducted using framework synthesis.
Results: 1757 articles were screened, and 39 articles included. Understanding treatment burden in PwP and caregivers was not the primary aim in any of the included studies. The main issues of treatment burden in Parkinson's disease are: 1) work and challenges of taking medication; 2) healthcare provider obstacles including lack of patient-centered care, poor patient-provider relationships, lack of care coordination, inflexible organizational structures, lack of access to services and issues in care home or hospital settings; and 3) learning about health and challenges with information provision. The treatment burden led to physical and mental exhaustion of self-care and limitations on the role and social activities of PwP and caregivers.
Conclusion: There are potential strategies to improve the treatment burden in Parkinson's disease at an individual level such as patient-centered approach to care, and at system level by improving access and care coordination between services. Future research is needed to determine the modifiable factors of treatment burden in Parkinson's disease.

Keywords: Treatment burden, burden of treatment, Parkinson's disease, caregivers, review, qualitative, experience

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INTRODUCTION

Parkinson's disease (PD) is a common, progressive neurodegenerative disorder. It is predominantly recognized as a movement disorder with tremor, rigidity, and bradykinesia. However, people with Parkinson's disease (PwP) experience a variety of non-motor symptoms such as bowel and bladder dysfunction, pain, fatigue, and problems with sleep [1]. There is also a high prevalence of neuropsychiatric disorders in PD such as apathy, depression, and dementia [2]. As PD progresses, PwP experience an increasing number of uncontrolled symptoms which are associated with poor quality of life [3]. Moreover, PwP are often older and have other long-term conditions such as hypertension and coronary heart disease [4, 5]. Unfortunately, there is no cure for PD. The mainstay of management in PD is to achieve symptom control, often with complex medication regimens and polypharmacy [5]. Surgical intervention with deep brain stimulation (DBS) may be suitable for a few PwP for whom medications fail to manage their symptoms [1].

Clinical experience suggests that PD is a long-term condition which may be associated with high treatment burden. Treatment burden is defined as 'the workload of healthcare and its impact on patient well-being and functioning' [6]. Some of the workload of managing health includes learning about a health condition, taking multiple medications, monitoring aspects of health, attending healthcare appointments and making lifestyle changes such as diet and exercise [6]. Patients may experience high treatment burden due to an imbalance between the workload of health and their ability to complete the workload with the available resources (sometimes termed 'capacity') [7]. High treatment burden is associated with poor adherence to treatment regimens, wasted resources, poor quality of life and poor health outcomes [8].

The majority of PwP are supported by family or friends (caregivers) who often not only assist them with activities of daily living but also help PwP manage their health and treatment-related activities such as medication taking and attending appointments [9]. Caregivers may experience treatment burden themselves as a result of looking after someone with a long-term condition as well as having to manage their own health. The treatment burden experienced by caregivers is different to the concept of caregiver burden, but may be interlinked [10]. Caregiver burden is a well-researched notion defined as 'the extent to which caregivers perceive that caregiving has had an adverse effect on their emotional, social, financial, physical, and spiritual functioning' [11–13]. Many tools have been validated and are widely used to assess caregiver burden [11, 14, 15]. However, the treatment burden experienced by caregivers and its association with caregiver burden is not well understood.

Identifying the treatment burden in patients with long-term health conditions can offer insights into potential practical steps to reduce the treatment burden or enhance capacity [8]. For example, Gallacher et al. found that the quality and configuration of health and social care services influenced the treatment burden in stroke [16]. Treatment burden has been studied in other conditions such as stroke, cancer, chronic kidney disease and patients with multimorbidity but not yet explicitly evaluated in PD [16–19]. We hypothesize that PwP and their caregivers experience high treatment burden when looking after their health. The aim of this systematic review was to understand the experiences of treatment burden among PwP and their caregivers.

MATERIALS AND METHODS

We conducted a systematic review of qualitative studies following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) approach [20]. The protocol is registered on the PROSPERO database: CRD42020172023.

Search strategy

A systematic search of the literature was conducted on five electronic databases: MEDLINE, Embase, CINAHL, Scopus and PsychInfo. A search strategy was constructed with the help of a senior librarian and is provided in the Supplementary Material. Table 1 summarizes the PICOS (Patient Intervention Comparison Outcomes Study) framework rationale for inclusion of articles.

Inclusion criteria were as follows: (i) participants were PwP and/or their caregivers; (ii) qualitative methods or mixed-method studies with a qualitative component; (iii) reported data from PwP and/or caregivers of PwP independent of other conditions; (iv) published in peer-reviewed journals. Exclusion criteria were as follows: (i) quantitative methods; (ii) qualitative data not related to usual care such as clinical trials or intervention; (iii) mixed-methods studies where qualitative data cannot be extracted; (iv) did not report data from PwP and/or caregivers of PwP independently of other conditions; (v) grey literature

Table 1
PICOS framework search strategy

PICOS elements	Description
Population	People with Parkinson's (PwP) aged > 18 years old Caregivers of PwP aged > 18 years old
Intervention	Experiences of usual treatment in any care setting: - home, care home, hospital, community, outpatient clinics, rehabilitation
Comparison	Not applicable
Outcome	Treatment burden
Study design	Qualitative studies or mixed-method studies with qualitative component

such as conference abstracts, book chapters, reports, commentaries and PhD theses.

No geographical limitations were applied. We limited our search to publications from year 2006 as this was the year of the first National Institute for Clinical Excellence (NICE) Clinical Guideline for Parkinson's disease in the United Kingdom (UK) [21]. This also allowed us to understand the impact of current healthcare systems on the treatment burden [22, 23]. Non-English (French, Portuguese, German, Norwegian, Spanish, Persian, Japanese) full-text articles ($n = 13$) were excluded following full-text screening due to a lack of available translation services.

Data screening and extraction

A single researcher (QYT) screened the study titles for relevance. Two researchers independently conducted abstract review (QYT & LC/SF/KI) and full-text article screening (QYT & NJC/SERL). Any disagreements were discussed between two researchers and agreed. Data extraction were conducted by two researchers independently (QYT & KI) using a pre-defined data extraction template created by the research team. The Cambridge Dictionary defines the word 'burden' as 'something difficult or unpleasant that you have to deal with or worry about' [24]. Therefore, data related to difficult or unpleasant experiences with tasks related to looking after health mentioned by PwP and/or their caregivers were extracted, even if the term 'treatment burden' was not mentioned. Data were extracted from the findings or results section of the included studies as the discussion and conclusion sections would likely not present any new primary data, only additional interpretations [25]. Relevant data were extracted if they were quotations from participants (first-order construct) or interpretations of the authors (second-order construct). As the focus of this review was on treatment burden experiences, data related to symptom burden or caregiver burden in PD that did not specifically relate to the workload of health were not extracted.

Data synthesis

Framework synthesis, guided by the domains in Eton's framework of treatment burden was used to analyze data [6]. Eton et al. developed a framework of treatment burden following interviews and focus groups with patients who had multiple chronic conditions other than PD [6, 26]. The finalized framework describe the three main themes of treatment burden as 1) the work patients must do to care for their health; 2) challenges or stressors that exacerbate felt burden; and 3) impacts of burden [6]. Framework synthesis is an iterative process widely used to synthesize qualitative research [27, 28]. It involves familiarization with the literature, identification of a thematic framework (Eton's framework of treatment burden in this review), applying the framework to code individual studies included in the review and creating charts with distilled summaries from the evidence. The charts were used to map the range and nature of aspects related to treatment burden in PwP and their caregivers and to find associations between the themes.

Data extracted from each study were thematically coded and then these codes were mapped against the components of Eton's framework and their subthemes. Data were read multiple times and text coded carefully whilst keeping an open mind to identify themes or concepts in the data that may have not been described by Eton's framework. Data were also organized and read according to first- and second-order constructs in order to understand the experiences of PwP and caregivers. Data synthesis was led by the primary researcher (QYT), closely supported by senior researchers (KI & HCR). The findings were discussed within the study team and consensus reached.

Quality rating

Quality appraisal was conducted by two researchers (QYT & NJC) independently and answers compared and discussed. The quality of studies

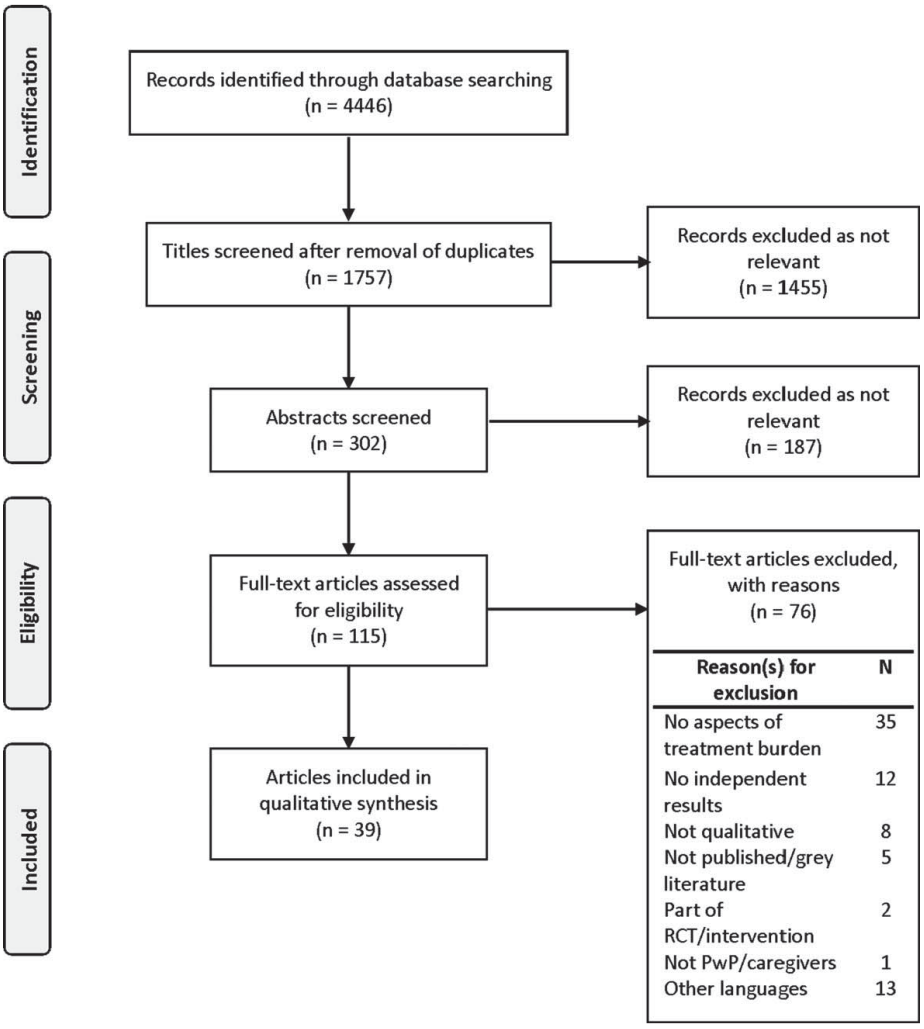

Fig. 1. PRISMA flow diagram.

was assessed using the Critical Appraisal Skill Programme (CASP) criteria for qualitative studies that considers the appropriateness of the research methods and whether the study findings are well-presented and meaningful [29]. The CASP consists of ten questions and is a well-established tool that is used to assess the methodological rigor of qualitative studies. Questions with 'Yes' responses were scored one point to give an overall quality score for each study.

RESULTS

Included articles

The number of papers screened, assessed for eligibility and included in this review are presented in the PRISMA flow diagram (Fig. 1). Thirty-nine articles were included in this review. A summary of the studies is presented in Table 2.

Table 2
Summary of included articles

Author(s), year and country	Number of participants and gender	PwP and/or caregivers ages (y)	Severity of PD (y)	Living arrangements of PwP	Qualitative methods	Primary aim	CASP score (/10)
Abendroth et al. 2012 (USA) [30]	20 Caregivers (3M,17F)	N/A	Length of diagnosis range = 3–23	Home and care home	Interviews	To understand how caregivers make decisions to institutionalize a relative with PD	8
Armitage et al. 2009 (UK) [39]	24 PwP 51 Caregivers (Gender N/A)	N/A	N/A	RH or NH	Interviews	To explore the care of persons with PD who are care home residents	8
Barken 2014 (Canada) [59]	8 Caregivers (4M,4F)	>65	All had physical impairment due to PD	N/A	Observations at support meetings and interviews	To examine the biographical trajectories of people caring for a spouse with PD	9
Berger et al. 2019 (USA) [51]	20 Caregivers (8M,12F)	Caregivers mean = 68 PwP mean = 68	H&Y stages 2 to 4; Mean length of diagnosis = 9	N/A	Interviews	To explore the concept of social self-management of spousal caregivers of people with PD	8
Boersma et al. 2017 (USA) [48]	11 Caregivers (2M,9F)	Caregivers mean = 65 PwP mean = 65	H&Y stages 2 to 4	N/A	Interviews and 1 focus group	To elicit PD caregiver needs, salient concerns, and preferences for care using a palliative care framework	9
Buetow et al. 2010 (New Zealand) [43]	13 PwP and 7 proxies (14M,6F)	14 PwP > 65 6 PwP < 65	Mean length of diagnosis = 11	N/A	Interviews	To explore experience and factors that contribute to errors around medication timing for PD	8
Dauwerse et al. 2014 (Netherlands) [56]	Interviews: 27 PwP and Caregivers (15M,12F) Focus groups: 30 PwP (20M,10F)	Interviews: 5 PwP < 56 22 PwP ≥ 56 Focus groups: 11 PwP < 56 19 PwP ≥ 56	Length of diagnosis Interviews: 7 PwP ≤ 3 20 PwP > 3 Focus groups: 11 PwP ≤ 3 19 PwP > 3	Interviews: Home and NH Focus groups: Home	Interviews and focus groups	To give an overview of quality of life from the perspective of patients with PD	10
Dekawaty et al. 2019 (Indonesia) [52]	5 Caregivers (Gender N/A)	Range = 31–67	Length of diagnosis range = 2–7	N/A	Interviews	To explore family members' experiences in caring for relatives with PD	6
Den Oudsten et al. 2011 (International – 7 countries) [36]	38 PwP 8 Caregivers (Gender N/A)	PwP means range = 54.4 – 74.3 (7 groups) Caregivers means = 52.0 and 56.8 (2 groups)	N/A	Home	Focus groups	To add qualitative knowledge about PD and quality of life	7

(Continued)

Table 2
(Continued)

Author(s), year and country	Number of participants and gender	PwP and/or caregivers ages (y)	Severity of PD (y)	Living arrangements of PwP	Qualitative methods	Primary aim	CASP score (/10)
Drey et al. 2012 (UK) [40]	15 PwP (9M,6F)	Range = 44–74	Length of diagnosis range = <1–17	Home	Interviews	To provide descriptions of adherence and non-adherence to medication by people with PD	10
Duncan et al. 2011 (Australia) [41]	22 PwP 8 Caregivers (Gender N/A)	PwP means > 60 (4 focus groups) Caregivers N/A	N/A	N/A	Focus groups	To examine the dynamics of healthcare delivery to PwP and their caregivers in New South Wales	6
Fox et al. 2017 (Ireland) [54]	19 PwP (13M,6F) 12 Caregivers (1M,11F)	PwP mean = 67.9 Caregivers mean = 68.2	PwP mean length of diagnosis = 7.25 Caregivers mean length of diagnosis = 5.4	Home	Interviews	To explore the palliative care and related issues affecting people with PD and their families	9
Giles and Miyasaki 2009 (Canada) [57]	3 PwP (1M,2F) 4 Caregivers (1M,3F)	PwP range = 71–77 Caregivers range = 36–75	H&Y stages 3 to 5	N/A	Interviews	To understand the healthcare experiences and needs of persons living with palliative stage PD and family members	10
Haahr et al. 2010 (Denmark) [31]	9 PwP (6M,3F)	Mean = 61	Mean length of diagnosis = 15	N/A	Interviews	To explore the experiences of patients with advanced PD during the first year of DBS	9
Haahr et al. 2011 (Denmark) [32]	11 PwP (8M,3F)	Mean = 60	Mean length of diagnosis = 15	Home	Interviews	To explore patients' lifeworld with advanced PD prior to DBS and expectations following DBS	9
Habermann et al. 2017 (USA) [47]	14 PwP (7M,7F) 14 Caregivers (7F,7M)	PwP mean = 73.3 Spouse mean = 72.1	Mean length of diagnosis = 12.18;. Mobility dependent on assistive devices	Home at baseline, 3 PwP in care home at 3 months	Interviews	To describe the needs, concerns and preferences of couples with advanced PD as they plan the care needed for the future	9
Hasson et al. 2010 (UK) [55]	15 Caregivers (4M,11F)	> 55	N/A	PwP that have recently deceased	Interviews	To explore former carers' lived experiences of palliative and end-of-life care in PD	9
Hounsgaard et al. 2011 (Denmark) [33]	10 Caregivers (10F)	Mean = 65.8	Mean length of diagnosis = 3.7	Home	Interviews	To throw light on the lived experiences of female partners of patients with PD living at home	9

Hudson et al. 2006 (Australia) [53]	8 PwP (4M,4F) 21 Caregivers (6M,15F)	PwP range = 40 to > 80 Caregivers range = 41–80	Median length of diagnosis = 11	N/A	Interviews	To describe the experiences of PD and consider the relevance of palliative care for this population	9
Hurt et al. 2017 (UK) [38]	18 Caregivers (8M,10F)	Mean = 65.4	Mean length of diagnosis = 10.3	N/A	Interviews	To investigate the nature of illness uncertainty in the carers of patients with PD	10
Mclaughlin et al. 2010 (UK) [9]	26 Caregivers (9M,17F)	21 Caregivers (81%) > 55	Length of caregiving = 2–20	Home	Interviews	To explore the experience of informal caregivers of people with PD	8
Mclennon et al. 2010 (USA) [66]	2 PD Caregivers (Gender N/A)	All participants mean = 79.5	Mean H&Y = 3.25	N/A	Interviews	To identify common themes from caregivers who institutionalize their relative with Alzheimer's or PD	7
Mshana et al. 2011 (Tanzania) [63]	Interviews: 28 PwP and 28 Caregivers (All participants = 32M,30F) Focus groups: 50 participants (unclear role) (24M,26F)	PwP range = 45–94	N/A	Home	Interviews and focus groups	To investigate the experience and treatment seeking behaviors of PD sufferers and their caregivers together with community understandings of PD in a rural part of Tanzania	7
Nunes et al. 2019 (Brazil) [64]	20 Caregivers (4M,16F)	Range = 37–85	N/A	Home	Interviews	To investigate the facilitator and inhibitory factors in elderly caregivers with PD	8
Pateraki 2019 (Greece) [60]	19 PwP 13 Caregivers (Gender N/A)	PwP range = 46–72	N/A	Home	Interviews	To explore patients' experience with DBS, with a focus on the temporal dimension	4
Rastgardani et al. 2019 (USA) [37]	20 Caregivers (11F,9M)	PwP mean = 65.1	Mean length of diagnoses = 7.8	N/A	Interviews (secondary data analysis)	To explore how caregivers of PwP are engaged by clinicians in discussions of "off" periods	8
Read et al. 2019 (UK) [44]	10 PwP (7M,3F)	Mean = 77	H&Y stage 4 or 5; Mean length of diagnosis = 18	Home and NH	Interviews	To explore experiences of service use and unmet care needs of late stage PD	10
Roland et al. 2010 (Canada) [46]	5 Caregivers (5F)	Range = 49–71	Length of diagnosis range = 2–14	N/A	Repertory grid methodology	To determine the aspects of care that are most salient to caregiver burden and in PwP	6

(Continued)

Table 2
(Continued)

Author(s), year and country	Number of participants and gender	PwP and/or caregivers ages (y)	Severity of PD (y)	Living arrangements of PwP	Qualitative methods	Primary aim	CASP score (/10)
Shaw et al. 2017 (UK) [34]	12 PwP (7M,5F)	Male range = 60–86 Female range = 51–70	Length of diagnosis range = 11 months to 24 years	Home	Interviews	To investigate the current ethical issues in relation to recognizing and managing PD from the patients' perspective	7
Shin et al. 2015 (USA) [35]	16 PwP (11M,5F) 5 Caregivers (2M,3F)	PwP mean = 68.1 Caregivers mean = 73.2	Mean length of diagnosis = 5.4	Home	Interviews	To describe challenges in medication adherence and identify strategies to facilitate adherence in people with PD	9
Shin et al. 2016 (USA) [67]	16 PwP (11M,5F) 5 Caregivers (2M,3F)	PwP mean = 68.1 Caregivers mean = 73.2	Mean length of diagnosis = 5.4	Home	Interviews	To understand experiences of people with PD to initiate medication therapy for PD	9
Smith and Shaw 2017 (UK) [49]	4 PwP (2M,2F) 5 Caregivers (2M,3F)	PwP range = 67–75 Caregivers range = 67–85	Length of diagnosis range = 2 to 21	Home	Interviews	To investigate family members' lived experience of PD aiming to investigate opportunities for well-being	7
Soleimani et al. 2016 (Iran) [65]	17 PwP (10M,7F)	Range = 60–90	H&Y stages 1 to 5; Length of diagnosis range = 1 to 21	Home	Interviews	To explore the primary concerns and perceptions of patients living with PD	8
Tan et al. 2012 (Singapore) [50]	21 Caregivers (4M,17F)	Caregivers range = 31 to > 71 PwP range = 41 to > 71	H&Y stages 1–5	Home	Interviews	To conduct an in-depth qualitative examination of the experiences of Singaporean people caring for those with PD	8
Van der Eijk et al. 2011 (Netherlands) [58]	40 PwP (30M,10F) 20 Caregivers (5M,15F)	PwP mean = 61.9 Caregivers mean = 63.0	H&Y stage 1–3; Mean length of diagnosis = 6	Home	Focus groups	To explore the experiences of PD patients and their informal caregivers concerning received healthcare	8
Van Rumund et al. 2014 (Netherlands) [45]	15 PwP 15 Caregivers (20F,10M)	Mean = 77.1	H&Y stages 3–5; Mean length of diagnosis = 11.4	NH	Interviews	To analyse the quality of PD care in NHs	8
Walga 2019 (Ethiopia) [61]	20 Caregivers (7M,13F)	Caregivers range = 14–66 PwP range = 50–89	Mean length of diagnosis = 5	N/A	Qualitative survey questionnaire	To explore the lived experiences and perspectives of PD patients' caregivers	5
Williams and Keady 2008 (UK) [42]	26 PwP and Caregivers (Gender N/A)	PwP range = 61–89	Late-stage disease using H&Y	Home	Interviews	To examine the experiences of older people with late-stage PD and the transitions experienced by patients and their families	9
Williamson et al. 2008 (UK) [62]	10 Caregivers (10F)	Mean = 70	Mean length of diagnosis = 11	Home	Interviews	To present caregivers' experience of living with a partner with PD and psychotic symptoms and coping strategies	10

CASP, Critical Appraisal Skills Programme; DBS, Deep brain stimulation; F, Female; H&Y, Hoehn and Yahr staging; M, Male; NH, Nursing home; PD, Parkinson's disease; PwP, People with Parkinson's; RH, Residential home, UK, United Kingdom; USA, United States of America; Y, Year.

Studies were conducted in multiple countries including: UK (N = 10), United States of America (USA) (N = 8), Canada (N = 3), Denmark (N = 3), Netherlands (N = 3), Australia (N = 2), Brazil, (N = 1), Ethiopia (N = 1), Greece (N = 1), Indonesia (N = 1), Iran (N = 1), Ireland (N = 1), New Zealand (NZ) (N = 1), Singapore (N = 1) and Tanzania (N = 1). One international study was conducted across seven countries (Czech Republic, Italy, Netherlands, Norway, NZ, Spain, and UK). Qualitative studies were mainly conducted using interviews (N = 29), focus groups (N = 3) or both interviews and focus groups (N = 3). One study conducted secondary data analysis of interviews, one study conducted participant observation and interviews, one study conducted repertory grid methodology and one study conducted a qualitative survey questionnaire. Participants in the studies included PwP or their proxies (N = 7), caregivers (N = 16) or both PwP and caregivers (N = 16). A total of 933 participants were included in the review; 413 PwP, 435 caregivers and 85 participants where it was unclear whether they were PwP or caregivers.

Quality appraisal

Most articles (N = 34/39) were of good quality and scored seven or more points using the CASP qualitative appraisal tool (see Supplementary Material). Understanding the treatment burden in PD was not the primary aim of any of the included studies. The majority (N = 29/39) of studies failed to consider the researcher-participant relationship. As there is no consensus on assessing the quality of qualitative research, no studies were excluded based on quality.

Treatment burden in PD

Our findings support the use of Eton's framework of treatment burden in PD and are summarized in Table 3. The subthemes within the three main themes from Eton's framework are ordered in Table 3 based on the subtheme with the highest number of codes, with supporting quotes provided. No aspects of treatment burden identified fell outside our coding framework. We found that the main issues of treatment burden in both PwP and caregivers relate to medications, healthcare provider obstacles and information provision. The treatment burden led to physical and mental exhaustion of self-care and limitations on the role and social activities of PwP and caregivers.

Main issues of treatment burden in PD

Medications

PwP reported taking multiple medications at different times of the day with prescriptions being changed and adjusted regularly over time to find the right dosage to help mitigate their symptoms [30–36]. PwP were supported by their caregivers with managing and administrating medications as well as reminding them of medication times [9, 30, 33, 37, 38]. The unpredictability and fluctuating symptoms of PD as well as the variability of PD medication effectiveness on a daily basis were some of the reported challenges with medication taking [35, 38–41]. PwP and caregivers monitored the response to PD medications and trialed different medication doses and timings as well as experimenting with other factors such as diet, sleep and exercise to see if this influenced their PD symptoms [33, 35, 37, 38]. PwP also described the 'wearing off' effect of PD medications causing poor control of symptoms between doses [36, 40–42]. This led to frequent changes in medications timings and doses, at times on a 'trial and error' basis, causing considerable confusion regarding medications [38]. Increasingly visible tremors due to the lack of medication effectiveness caused PwP to worry that the medications were not working [40]. The lack of positive symptom response observed by PwP (but not by family members) was reported as a reason for poor medication adherence [35]. Other reasons for poor adherence reported by both PwP and caregivers were forgetting to take medications, confusion about which tablets were due or being preoccupied with work or social activities [32, 35, 40, 43].

Other challenges with taking medications experienced by PwP and caregivers related to the precise timing of medications to avoid the return of symptoms, planning of mealtimes and diet due to PD medications and medication side-effects [32, 35, 36, 40–45]. PwP and caregivers described planning and scheduling activities such as exercise, shopping, meeting family or friends or clinical appointments around their medication timings [30–32, 36–38, 40]. They established a daily routine around times when their medications were most effective [32, 35, 36, 40, 42]. This was especially important if they had social plans to avoid any distress or embarrassment as PwP did not want their symptoms to be noticed by others [32, 40]. Some reported that the fixed schedule of medication timings interfered with their personal daily activities at times [32, 35, 36, 46]. There were contrasting attitudes towards medication adjustments

Table 3
Experiences of treatment burden in PwP and caregivers

Eton's framework of treatment burden		Treatment burden experiences of PwP and caregivers	Quotations from studies
Theme	**Subtheme** (Number of codes)		
Work patients must do to care for their health	Medications (40)	Multiple medications with frequent adjustment of medication doses and timing; plan and schedule medication timings around daily activities; dependence on medications; manage diet and medication	*"As I have to take medication seven times a day, you need to keep certain times, and then you come to accept that you have to stick to those times within a margin of 10 minutes. You can almost set your clock by it [32]." [PwP]*
	Medical appointments (15)	Organize and attend regular medical appointments with multiple healthcare professionals	*"All interviewees reported regular appointments with their GP, PD nurse, and neurologist, but not access to the multi-disciplinary team (MDT) that is recommended for maintaining Quality of Life [34]." [Author]*
	Learn about conditions and care (11)	Learn about PD, progression of PD and other health conditions; learn about medications and medication side-effects; learn about available resources and services	*"I really think support groups are really beneficial in understanding what the disease is, how it progresses, how it's medicated, what the side issues are, and right now I'm learning about co-morbidity that was never much of an issue until recently and now we were dealing with a variety of issues related to, or incidental to, Parkinson's [35]." [PwP]*
	Health behaviors (10)	Diet; exercise; supplements	*"This participant has also tried several other modalities such as exercise, supplements and chemo Chelation prior to initiating any medication therapies. This participant also continued to take the following supplements along with antiparkinsonian medication [67]." [Author]*
	Monitoring health status (7)	Monitor response to PD medications; monitor other chronic medical conditions	*"Specifically, difficulties managing chronic medical conditions were expressed. For example, one caregiver discussed problems managing her husband's blood sugar levels because of erratic eating patterns [66]." [Author]*
	Medical devices – Deep Brain Stimulation (5)	Adjustment of deep brain stimulation settings following implantation	*"It has been going very slowly and that's hard when you are impatient, having to wait for a whole week to see what the adjustment did. And then having a new adjustment and then wait another week. It has been like that for six or seven weeks [31]." [PwP]*
Challenges or stressors that exacerbate felt burden	Challenges with taking medication (36)	Precise timing of PD medications; challenges with medication adherence; fluctuation of PD medication efficacy; progression of PD symptoms and on-off symptoms; side-effects of medication	*"I'm worried about the tremors. They're very visible. If I'm standing or walking to the supermarket, it's very obvious. I'm concerned the medication is not doing what it's supposed to be doing [40]." [PwP]*
	Healthcare provider obstacles – system issues (32)	Poor availability and lack of access to healthcare and social services; lack of care coordination and continuity of care between services; poor service provision for severe PD; organizational structures of health and social care systems; challenges faced in care home or hospital settings	*"Either you could get a complete multidisciplinary team, either employed in an area to cover all neurological illnesses, or a team to cover one specific illness for maybe a larger area. Because there seems to be a vague boundary between the responsibilities that one person has and the responsibility another has. They just don't seem to work as a team or have any team effort as such [55]." [Caregiver]*

(Continued)

Table 3
(Continued)

Eton's framework of treatment burden		Treatment burden experiences of PwP and caregivers	Quotations from studies
Theme	**Subtheme** (Number of codes)		
	Confusion about medical information (28)	Level and quality of information about PD, prognosis with PD, medications, and available services (lack of information, too much information and/or contradicting information)	*"Some participants were missing basic information about PD, even to know that it is incurable. Some participants would have liked all of the information up front to prepare for advanced illness. 'I wanted to know, what I wanted to ask … is there a progression, is there a time scale … some people mightn't want to know about that at all, but I would prefer to know, so you can deal with it then, and you can be prepared for it.' [54]" [Author and PwP]*
	Healthcare provider obstacles – individual provider issues (18)	Lack of patient-centered care; poor relationships and unsatisfactory interactions with healthcare professionals	*"… but I used to sit there and think they aren't getting half the story just listening to how my husband perceives what's happening with him, and I thought it was really odd that the reaction to the person who is with him 24/7 isn't more important to these neurologists [37]." [Caregiver]*
	Financial challenges (13)	Cost of travel, appointments, medications, potential loss of financial income and lack of insurance coverage; personal payments due to lack of financial support and delays from health and social care support	*"He could not get his medication because the insurance refused to pay for it. So then, that is when you come in as a family and you have to think about that. How are we going to pay for that medication? I forgot which one it was, but it was $500.00. We had to decide how are we going to pay for that medicine [48]." [Caregiver]*
	Barriers to self-care (10)	Difficulty with travel and transportation; other chronic medical problems; lack of certainty on how to manage PD	*"I can't get to the hospital, because of setting it all up. The size of the car, couldn't' get in the taxi because it had seats, where they take the ramps up and sit there. Those are very expensive [44]." [PwP]*
	Interpersonal challenges (4)	Frustration at loss of independence; challenging relationships between PwP and caregiver	*"Now suddenly it's me that has to be the protective one. For a long time my husband would not admit that he was sick and therefore refused to take his medicine. I couldn't understand it, because his job was under threat due to the symptoms and the medicine would help [33]." [Caregiver]*
Impacts of burden	Role and social activity limitations (16)	Change in life role and responsibilities; impact on planning and attending social activities	*"I think this illness changed our lives in a very bad way, but my situation became worse about 2 years ago. A nuisance and trouble for others, I can no longer do anything on my own. I cannot even buy my drugs or go to the doctor alone, and one of my family members has to come with me. They're also busy themselves but it cannot be helped. Believe me, I cannot handle all this by myself [65]." [PwP]*
	Physical and mental exhaustions of self-care (10)	Physical and mental exhaustion completing the workload of health; uncertainty of managing health and making decisions regarding health	*"This woman was not able to direct others' attention to her need for support until she buckled under and became both physically and psychically worn out. She was not in receipt of support owing to lack of information about the available support from the health service system [33]." [Author]*

GP, General Practitioner; PD, Parkinson's disease; PwP, People with Parkinson's.

in PwP: those who described themselves being more flexible and changing their medication times or taking extra doses around their work or daily activities to manage their symptoms [35, 40, 42]; and those who only made changes in their medications after seeking advice from healthcare professionals [40]. Additionally, PwP and caregivers took careful consideration in planning their mealtimes and diet such as avoiding protein-rich meals to prevent drug and food interactions [30, 35, 40, 45]. Caregivers of PwP with swallowing difficulties also reported the need to consider how they could administer medications to the person with PD during mealtimes [47].

Managing the side-effects of taking PD medications such as compulsive behavior, frightening nightmares, hallucinations, disinhibition, dry mouth, drowsiness and insomnia were challenging for PwP and caregivers [34–36, 38, 40, 41, 48]. Some PwP also reported that the medications made them feel worse rather than helped their symptoms [34, 40]. PwP described taking medications as "the lesser of two evils", balancing the need for PD medications to help their symptoms alongside concerns of potential long-term side-effects of dyskinesia [35]. However, living with PD meant being dependent on medications, as PwP and caregivers described how they made sure they always had their PD medications with them when leaving the house [32, 35, 37, 40]. Furthermore, their dependence on medication increased as PD progressed and PwP described shorter time intervals between taking medications [32, 42].

Healthcare provider obstacles: Individual provider issues

PwP and caregivers described having to prepare for and attend separate appointments with doctors (General Practitioner (GP) and PD specialist), PD nurse specialist or physiotherapist [9, 30, 34, 37, 38, 41, 49–53]. Some reported issues with transportation and the additional time spent preparing and travelling to healthcare appointments [36, 44, 50, 53]. Moreover, PwP and caregivers in countries across different global regions such as the UK, Netherlands and Indonesia described a lack of patient-centered care from many healthcare professionals with a predominant focus on medication needs, rather than a holistic approach that considered their social, psychological and care needs which may be more distressing [36, 38, 52, 54–56]. PwP and caregivers in the UK described poor relationships and unsatisfactory interactions with healthcare professionals due to lack of consulting time and infrequent follow-up appointments [9, 55]. Caregivers reported attending healthcare appointments with the person with PD they cared for as they were worried that person with PD may forget to mention certain things and not remember the consultations at the end [37]. However, they found that their views and opinions were not considered during medical appointments, despite their active role in managing PD [33, 37, 48]. Some caregivers felt that they could not question or challenge the advice given by doctors, even if they did not fully understand the reasoning, due to the fear of being reprimanded [57]. Moreover, the predominant management of PD by specialists in the UK meant that PwP and caregivers felt that their GP lacked detailed knowledge about PD although they recognized that their GP still had an important role [9, 38, 55]. In Australia, they described the reluctance from GPs to adjust prescriptions without input from their neurologist, causing a delay in medication changes and management of PD [41].

Healthcare provider obstacles: System issues

Attending medical appointments with multiple healthcare professionals that all focused on different medical issues was challenging [38, 44, 58]. PwP and caregivers in Ireland, UK, Singapore and Netherlands experienced a lack of coordination, continuity of care and cohesion between the different health and social care services [9, 34, 38, 44, 50, 54, 55, 58]. PwP and caregivers reported a lack of clarity over the roles of health and social care professionals involved in their care, with no clear multidisciplinary approach [34, 55, 58]. They at times experienced contradicting advice regarding their health and available support services due to the poor cohesion between services [34, 54]. In addition, caregivers perceived that the lack of coordination between services resulted in inadequate monitoring of PD symptoms and medications [9]. PwP and caregivers also described how the inflexible organizational structures of the healthcare systems influenced their interactions with health professionals and care providers [39, 44, 59]. For example, care agency allocation of support workers based on geographical regions meant that they did not have visits from one regular support worker which prevented relationship building [59].

The poor availability of health and social care services increased the treatment burden for PwP and caregivers [9, 34, 38, 39, 41, 47, 52–58, 60, 61]. In countries such as Australia, Canada, Ireland and UK, PwP and caregivers described long waiting times and lack of access to specialist PD doctors

and allied health professionals such as physiotherapists and speech and language therapists, specialist palliative care or hospice services [38, 39, 41, 54, 55, 57]. The deteriorating mobility of the person with PD as the disease progressed meant PwP and caregivers experienced difficulty accessing healthcare and social services due to the limited availability of home visits from those services [39, 44]. Some PwP reported being discharged from specialist clinics to community services as they were physically unable to attend appointments, whilst other PwP made an active decision not to attend clinics as the difficulties of attending appointments and limited consulting time did not have any justifiable benefits as their PD progressed [44, 45]. PwP and caregivers also experienced poor access to social support and funding for home care support, home modifications and access to supportive equipment [9, 38, 47, 53, 56, 57]. Consequently, PwP and caregivers in UK with a publicly funded National Health Service reported making private payments for trained carers and respite as well as purchasing equipment individually due to the long waiting times for private carers and equipment [9]. Similarly in Australia, the inequitable funding system and limited access to home modifications added to the frustration and financial burden to PwP [53].

PwP and caregivers also faced specific challenges with looking after their health in care home or hospital settings, particularly with medications [39, 41, 43–45]. The multiple levels of systemic administration in healthcare caused delays of medication changes for one care home resident with PD as the prescription had to be passed from the hospital specialist to the GP, to the pharmacy before finally arriving at the care home [39]. Wrong instructions, delays in medication administration, a lack of awareness and knowledge regarding medication administration and contraindications for specific drugs including dietary requirements by staff were described by PwP in care homes or hospitals [39, 43–45]. The fixed schedules in care homes or hospitals meant that PwP and their caregivers found that they were unable to administer medications at their usual recommended specific time [41, 44, 45]. This inflexibility led to a loss of autonomy that not only impacted their medication schedules, but also their usual routine for personal care and meals [44].

Information

PwP and their caregivers reported that after being diagnosed with PD, they had to learn about PD, how PD progresses, other health conditions, medications, medication side-effects and available resources and services [30, 33, 35, 44, 48, 62]. However, PwP and caregivers across different countries and healthcare systems reported receiving inadequate information from healthcare professionals on topics such as dietary requirements, managing the progression of PD and prognosis of PD [9, 33, 36, 38–40, 48, 54, 57, 58, 62]. Due to the lack of information provided, PwP and caregivers reported searching for information themselves from the internet or support groups [9, 36, 40, 57]. However, some PwP and caregivers found unhelpful information that was not relevant to their situation which instead caused distress and made them feel worse about living with PD [9, 34, 40, 57]. Other PwP and caregivers actively chose not to search for information and avoided support groups as it reminded them of their inevitable deterioration with PD [40]. Some PwP and caregivers also described their confusion about medical information provided to them, with contradicting information from different healthcare professionals, at times feeling that they have been sent from "pillar to post" [34, 35, 54, 56].

Due to the lack of information regarding the progression and poor prognosis of PD, PwP and caregivers reported that they were unable to prepare for the advanced illness, plan for the future or make decisions about their health [9, 47, 48, 54]. PwP and caregivers across multiple countries including Canada, Denmark, Ireland, Netherlands, Norway, Spain and UK also reported a lack of guidance on relevant healthcare and social services or support that may be available [9, 33, 36, 38, 54–57]. Consequently, they were unable to access help from the appropriate services even though it may be beneficial [9, 36, 55, 56]. Furthermore, caregivers reported a lack of certainty on whether the symptoms of the person they cared for related to the PD or side-effects of medications [38]. They were uncertain about what changes in health circumstances constituted a need to seek help outside of their routine appointments [38]. Caregivers also commented on the lack of preparation and were unsure about what to do during emergency situations such as falls, resuscitation and psychosis due to the lack of information provided from healthcare professionals [48, 54]. Some caregivers described feeling responsible for obtaining information on their own due to the lack of regular appointments and contact with healthcare professionals [62].

Financial challenges

The financial challenges reported by PwP and their caregivers living in different countries with different healthcare systems related to the costs of travel, healthcare appointments, medications and treatments on top of the potential loss of earnings due to PD or caring for someone with PD as well as consideration of living expenses [35, 38, 41, 47, 48, 61, 63, 64]. Furthermore, the costs of private carers and the potential costs of care homes as PD progresses added to their concerns about financial stability [9, 38]. Studies conducted in Africa (Ethiopia and Tanzania) described a lack of medication supply with PwP and caregivers having to source medications themselves and then paying high medications costs [61, 63]. They also described how treatment decisions were made based on affordability of treatment, rather than medical need [63]. The financial burden of medications were also experienced by PwP and caregivers living in developed countries such as the USA, where they described additional high costs for medications despite already paying for medical health insurance cover [35, 47, 48].

Other aspects of treatment burden in PD

Other aspects of treatment burden in PD include the loss of independence, impact of other long-term conditions, lifestyle changes as well as issues related to DBS. Some of these aspects correlate to the subthemes described by Eton's framework of treatment burden and are highlighted in this section. As their PD progressed, PwP described frustrations due to *their loss of independence* and having to rely on others to manage their medications or attend medical appointments [65]. However, a strong sense of independence may potentially be detrimental to PwP and caregivers as it meant that some did not ask for help when required [57]. In addition, some caregivers occasionally felt *frustrated at the attitudes* of the person with PD and could not understand why they would not comply with medications or dietary recommendations [33, 52]. PwP and caregivers also described how other long-term health conditions such as diabetes and arthritis impacted their ability to manage their health [30, 38, 44, 51, 66]. For example, managing their diet or monitoring blood sugar levels due to their diabetes was challenging for PwP and caregivers [51, 66]. Caregivers also described how their own physical and mental health conditions interfered with their ability to help care for the health of someone with PD [66].

Looking after their health with PD meant PwP attended *exercise* classes including those specific to PD to maintain their level of functioning and prevent further decline, even if they were unsure of the beneficial effect [30, 37–39, 44, 51, 52, 56, 67]. PwP and caregivers also reported following *dietary requirements* to prevent interactions with PD medications or increased their intake of fruits to help digestion as advised by healthcare professionals [30, 37, 52]. PwP who had DBS implanted reported multiple adjustments to find the right level of stimulation settings and medication doses which at times was a long process and increased their number of hospital appointments [31, 60].

Impacts of burden

Role and social activity limitation

PwP and caregivers described how their role in life had changed and was spent managing their PD and health, with symptoms and medication efficacy that could be difficult to predict on a daily basis [31, 32, 36, 40]. PwP and caregivers reported how their daily lives were dictated by the schedules of medications and appointments of the person with PD [30]. Having to take medications at different times of the day as well as the variable medication efficacy and side-effects impacted their ability to plan or attend social activities outside of the home [32, 36, 46]. PwP reported increasingly relying on others for help as PD progressed, whilst family members or friends of the person with PD found themselves taking on the role of a caregiver [33, 49, 65]. Caregivers described a loss of independence as their lives now revolved around the PwP with unpredictable symptoms and medication schedules impacting their social activities [46, 51]. Some patients with DBS described how malfunction of the device could prevent them from engaging in new activities or disrupt their usual routine although others enjoyed the spontaneity that DBS gave them, no longer having to plan activities between medication timings [31].

Physical and mental exhaustion of self-care

PwP and caregivers reported that their day was filled with medications, appointments, therapy, diet and exercise; constantly reminding them of their life with PD and increasing recognition that they may not go back to living a normal life [9, 31, 33, 50]. The lack of contact with healthcare professionals meant that PwP and caregivers felt 'alone' when managing their PD [54]. Caregivers of PwP found themselves

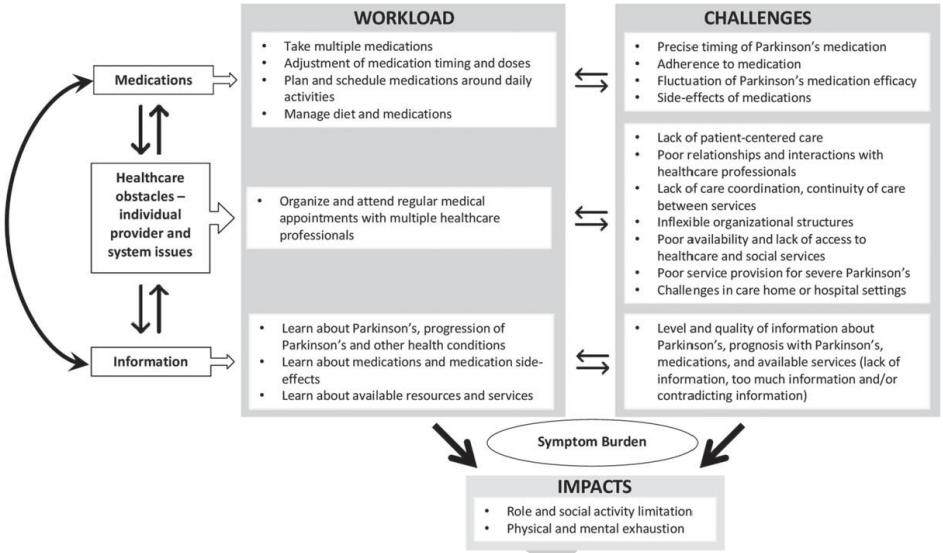

Fig. 2. Main components of treatment burden in Parkinson's.

responsible for the health of the person with PD, particularly as PD progresses and the capacity for self-care decreases [9, 33]. Caregivers described how the lack of information and uncertainty of what to expect with PD and having to make decisions about the care of their loved ones with PD was very stressful [48, 54]. The lack of information and access to available support services meant caregivers felt physically and mentally worn out [33, 54, 55]. The inevitable progression of PD and increasing dependence of PwP on their caregivers, who may themselves have a worsening health condition may eventually lead to the person with PD moving into placement to help manage their care [30].

DISCUSSION

To the best of our knowledge, this is the first systematic review to explore the treatment burden in PwP and their caregivers. None of the included articles in this review explored the concept of treatment burden as the primary outcome. Using Eton's framework of treatment burden, our findings suggest that the main issues of treatment burden in PwP and caregivers relate to: 1) the workload and challenges of taking medications, 2) healthcare provider obstacles at individual and system level and 3) learning about health and poor information provision regarding PD and available resources. Although Eton's framework was useful in identifying the issues of treatment burden in PD, it was challenging to separate the three themes (workload, challenges, and impact) as described in Eton's framework. Indeed, these constructs of treatment burden have been shown to correlate with one another in studies involving patients with multiple long-term conditions that have used a patient-reported outcome measure for treatment burden based on Eton's framework [68, 69]. The main issues that impact the treatment burden in PD appear to be closely interlinked, as shown in Fig. 2.

Firstly, the workload and challenges of medications in PD were closely related. The workload of medications experienced by PwP and caregivers may be increased by challenges such as strict medication timings, variable medication efficacy, medication side-effects and issues with medication adherence. For example, the variable medication efficacy led to frequent changes in medication doses and timings. Similarly, managing the side-effects of medications meant that they took more medications which added to their workload. Secondly, the work of organizing and attending medical appointments was challenging due to the healthcare obstacles faced by PwP and caregivers. At an individual provider

level, PwP and caregivers experienced poor relationships with healthcare professionals and a lack of patient-centered care when attending healthcare appointments. They reported a predominant focus on medications or symptoms rather than psychosocial factors that may be more distressing in PD. At a system level, the lack of access to services and lack of coordination between services meant that PwP and caregivers experienced a lack of information or conflicting information about their health. In some cases, this meant that they had to seek out information themselves, increasing the workload. Finally, the work and challenges with information provision added to treatment burden in PD. PwP and caregivers described learning about PD, how it progresses, medications, side-effects and how to access healthcare services. Yet, they experienced poor information provision and difficulty getting suitable levels of information. This meant that they looked for information themselves from support groups or the internet, increasing their workload. Furthermore, poor information provision meant that PwP and caregivers reported a lack of access to health and social care services as they were unaware of the available services to them. Both the workload and challenges of treatment burden impact the lives of PwP and their caregivers and led to limitations in their role and social activity as well as physical and mental exhaustion of self-care. Our review has also highlighted PD-specific issues of treatment burden such as fluctuation of PD medication efficacy, impact of PD symptoms and progression of disease on treatment burden, lack of PD prognostic information, lack of service provision for severe PD, challenges faced in hospital or care home settings with PD and issues related to DBS.

The medications aspect of treatment burden was a recurring issue in PD. This is not surprising given the predominant management of PD with medications. Polypharmacy, complex medication regimes, medication side-effects, coordinating medications, associated stigma and interference of medications on daily activities have been reported as important factors that increased the treatment burden in patients with a chronic illness, multimorbidity (two or more chronic conditions) and heart failure [70–73]. Patients with heart failure experienced the constant changes or adjustments in medications which increased their treatment burden, similar to experiences of medications in PD [70, 73]. Deficiencies of healthcare providers at both individual and system level have also been described as important factors that increased the treatment burden in other long-term conditions [16, 23, 70, 72, 74]. Poor communication, lack of trust and lack of continuity between patients and healthcare professionals have been found to increase the treatment burden in patients with multiple chronic conditions [26, 72]. A study exploring the treatment burden in stroke reported how healthcare provider issues at a system level such as the lack of communication between services led to confusion about medication prescriptions, which resonates with our findings that these issues are closely interlinked in PD [16]. Although PwP and caregivers had various sources of information available, issues with getting appropriate levels of information regarding PD and available services appear to impact on the treatment burden in PD. The lack of information provision is similar to previous literature on treatment burden in stroke, heart failure and chronic kidney disease [73–75]. Similar to our findings, patients with heart failure and chronic kidney disease also reported the lack of prognostic information and unpredictable future faced [18, 76, 77].

Furthermore, caregivers of PwP reported how their daily lives were dictated by medications, appointments and lifestyle changes whilst seeking information about PD and learning how to successfully navigate the healthcare system. They reported that the treatment burden led to changes in their role, loss of independence, feeling isolated due to the lack of support, and being physically and mentally exhausted. Even though we were careful not to extract data related to caregiver burden, our findings suggest that treatment burden experienced by caregivers in PD may be associated with caregiver burden. This is similar to findings from Sav et al who reported that caregivers of people with a chronic condition may experience treatment burden which can lead to distress, frustration and caregivers neglecting their own life and needs, including their health and well-being [10]. The relationship between treatment burden experienced by caregivers and caregiver burden has not been fully explored, and further research is needed.

Whilst we specifically did not extract data related to symptom burden in the review, our findings suggest that the symptom burden in PD may impact the treatment burden and capacity in PwP and caregivers due to the myriad of motor and non-motor symptoms associated with PD. Although symptom burden is a separate concept on its own, changes in disease severity, disease control and co-morbidities are closely linked to treatment burden and capacity [7, 78]. Higher levels of symptom severity is associated

with higher levels of treatment burden in studies conducted in older adults with multimorbidity and people living with HIV [79, 80]. However, the impact of symptoms burden on treatment burden in PD has not been researched.

Although a large cohort study found that 31% of PwP have more than five co-morbidities (physical and mental conditions) compared to 13% in patients without PD, aspects of treatment burden associated with long-term health conditions other than PD were mentioned less often than we anticipated in our review [5]. This may be because PwP and their caregivers predominantly experience treatment burden related to PD as they must manage the symptoms and complications of PD on a daily basis compared to other long-term health conditions. A previous study developing and validating the Multimorbidity Treatment Burden Questionnaire (MTBQ) as a measure for treatment burden showed that high treatment burden is associated with higher number of long-term conditions, depression and dementia [81]. All these factors are commonly found in PwP, further supporting our hypothesis that they are a population at risk of experiencing high treatment burden.

Implications

Our findings suggest PwP with high medication burden, those who navigate through multiple healthcare services, as well as those with inadequate information provision may experience high treatment burden. It is equally important for healthcare professionals to be aware that caregivers of PwP may also experience similar issues with treatment burden when helping to support the health of someone with PD. Healthcare professionals need to recognize PwP and caregivers who may have high treatment burden as they are potentially at risk of treatment non-adherence and subsequent poor health outcomes. Establishing patients' and caregivers' priorities with good communication and a move towards patient-centered care with a holistic approach by healthcare professionals can play a role in improving the treatment burden in PD [8, 82]. Perhaps reframing healthcare delivery using 'Minimally Disruptive Medicine', an approach that considers the impact of the workload of healthcare for people with long-term conditions and moves away from disease-centered guidelines may potentially be beneficial [83–85]. Further research is needed to understand the factors at both an individual and system level that can reduce the treatment burden or enhance the capacity of PwP and caregivers.

Strengths and limitations

Our review included 32 studies that involved caregivers of PwP. This is a strength as a recent systematic review by Sheehan et al. highlighted the lack of research exploring treatment burden experiences in caregivers, with only six studies doing so [86]. These studies involved caregivers of older adults, caregivers of older adults with multimorbidity, caregivers of patients with lung cancer and chronic obstructive pulmonary disease, older adults or caregivers of patients with at least one chronic condition such as diabetes, cardiovascular disease or cancer [10, 23, 72, 87–89]. The use of specific search terms in Sheehan et al.'s systematic review may have led to the exclusion of studies exploring caregiver burden that contained experiences of treatment burden in caregivers. In our review, the broad search terms used led to the inclusion of multiple studies involving caregivers and allowed the interpretation of treatment burden experiences in caregivers of PwP. Data synthesis was conducted using framework synthesis guided by Eton's framework of treatment burden, although other frameworks such as the Normalization Process Theory and Cumulative Complexity Model have been used for qualitative synthesis of treatment burden experiences [71, 74]. Our review has several limitations. Firstly, none of the studies explored treatment burden as the primary aim. Although we did find various aspects of treatment burden from the included articles, we did not extract data from the original interview transcripts of studies. However, data extraction was conducted by two researchers independently and discussed to increase rigor. Secondly, we included papers published from year 2006 onwards to identify the current experiences of PwP and caregivers following the introduction of the NICE UK PD guidelines, which may be different to PD guidelines in the other countries included in this review. However, exploration of the current experiences will help inform the development and changes to health services and/or policy for service users [23, 74]. Exclusion of grey literature and non-English articles may also be a limitation. However, we did not apply any geographical exclusion in order to capture important experiences across different countries and healthcare systems. Whilst we were careful to include all aspects of treatment burden during data extraction, prior knowledge of Eton's framework may have influenced data extraction. However, Eton's framework was created with patients with multimorbidity

and therefore suitable for this study as PwP can be considered an exemplar for patients with multimorbidity [5].

CONCLUSIONS

We have explored the experience and influences on treatment burden among PwP and their caregivers which have offered an insight into potential strategies to reduce the treatment burden. Eton's framework of treatment burden is a robust tool that can be used to understand treatment burden in chronic diseases including PD. Medications, healthcare provider obstacles at individual and system level as well as information provision appear to increase treatment burden in PD. Future research is needed to focus on treatment burden as the main outcome for PwP and their caregivers and identify the potentially modifiable factors that may improve their experiences.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

SUPPLEMENTARY MATERIAL

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Appendix I Interview Guide: Person with PD

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INTERVIEW GUIDE: Exploring the treatment burden and capacity of people with Parkinson's

The questions included are outlines of the areas that we have identified in the literature that we would like to explore.

Introduction

1. Give complete name.
2. Introduce self as researcher from Academic Geriatric Medicine at the University of Southampton.
3. Give short explanation about the study and purpose of the interview.
4. Discuss confidentiality and confirm consent for audio recording.

- *I would like to understand your experiences of looking after your health and living with Parkinson's. I want to find out your views on how you have learnt to live and deal with your condition, the treatments and advice you have been given.*
- *There are no right and wrong answers, whatever you say will be helpful and allow us to get a better understanding of the issues. Please let me know if you find any issues distressing or if you do not wish to answer any question. If at any time you want to stop, or have a break, please feel free to let me know.*
- *Everything you tell me today will be kept confidential. I will be recording the interview, so I can remember all you have said to me.*
- *I would like to start by asking some generic questions about your Parkinson's.*

General Questions about Parkinson's

1. How long have you been diagnosed with Parkinson's?
   How did you get diagnosed? Who did you see? How long did it take?
2. How did you get information about Parkinson's?
   How easy or difficult was it obtaining the information?
   How easy or difficult do you find understanding the information about Parkinson's?
3. Do you have other medical conditions? What are they?
   Which of your medical conditions including Parkinson's do you consider to be the main issue at this moment?
4. What has the impact of Parkinson's been on your life or social networks?
5. Do you feel overstretched with everything you need to do for your Parkinson's?

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Treatment Burden in Parkinson's

Thinking about your Parkinson's…

6. Are there aspects of looking after your Parkinson's that you find difficult of challenging? What are they?

The following topics will be explored in an open fashion if appropriate, building on the response from participants to Question 6:

a. Do you **monitor** your Parkinson's? What do you do to monitor your Parkinson's? What aspects do you find difficult or challenging?

b. How do you manage your **medications and prescriptions**? What do you do? Are there any challenges with this? How many treatments/medications do you take?

c. Have you had any **financial** expenses associated with managing your Parkinson's? What was that for? Was there any help with that?

d. How many times have you seen your **GP** about your Parkinson's in the last 12 months? Tell me about your experiences at the GP. Can you tell me about your experiences with your GP before COVID?

e. How many **hospital appointments** have you had for your Parkinson's in the last 12 months? Tell me about your experiences at the hospital appointment. Can you tell me about your experiences with hospital appointments before COVID?

f. Have you had contact or access to **other healthcare services** (district nurses, physiotherapist, occupational therapist, speech therapist etc.)? How do you find attending all the appointments?

g. Have you had any issues **getting help at the weekends or overnight**? How did you find this experience?

7. What do you do if you have a **concern or question** about your Parkinson's? Tell me about your experiences of getting hold of your Parkinson's doctors/GP/nurse specialist/therapist. Was this different before COVID?

8. What are your thoughts about how your **care is coordinated** between all the health care professionals such as your GP, hospital doctors, therapists or nurses? Have you had to do anything to resolve any issues or miscommunication?

Capacity

9. What things have helped you deal with the issues you have mentioned earlier such as…? *(remind them of the issues that was mentioned from previous questions)*

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10. Do you have help from anyone such as a family or friend to help with your Parkinson's?
11. Do you have any paid carers that help you with your personal care?
    If yes - how easy or difficult was to organise this? If no – why not?
    Are you aware of where to get information about getting more help if needed?
12. How can the healthcare system could be changed to help you manage your health with Parkinson's?
13. Is there anything else you like to add?

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Interview Details

Subject ID:	
Date of Interview:	
Time of Interview:	
Interviewer:	

Participant Profile

1. Age:
2. Gender: ☐ Male ☐ Female
3. Relationship of caregiver (if they have one):
4. Living arrangements: ☐ Alone
   ☐ With Spouse/partner/family/friend
   ☐ Other: _____
5. Ethnicity: ☐ White
   ☐ Asian/Asian British
   ☐ Black /African/Caribbean/Black British
   ☐ Mixed/Multiple ethnic groups
   ☐ Other (please specify) _____
6. Can you tell me if you went onto any further education after secondary school?

   ☐ No ☐ Yes (please describe: _____)
7. How does your Parkinson's affect you at present? (tick one box)
   ☐ No sign of disease
   ☐ Parkinson's symptoms on one side of the body
   ☐ Parkinson's symptoms on both sides of the body with no balance problems
   ☐ Mild to moderate Parkinson's symptoms on both sides of the body with some balance problems but still physically independent
   ☐ Severe disability but still able to walk or stand unassisted
   ☐ Wheelchair-bound or bedridden unless assisted

Close of the interview

Thank you for your time and participation. I would like to reassure you that everything you told me will be kept confidential and identified only by an identity number.

Appendix J Interview Guide: Caregiver

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<u>INTERVIEW GUIDE:</u> Exploring the treatment burden and capacity of caregivers of people with Parkinson's

The questions included are outlines of the areas that we have identified in the literature that we would like to explore.

Introduction

1. Give complete name.
2. Introduce self as researcher from Academic Geriatric Medicine at the University of Southampton.
3. Give short explanation about the study and purpose of the interview.
4. Discuss confidentiality and confirm consent for recording.

- *I would like to understand your experiences of helping to care and support the health of someone living with Parkinson's. I want to find out your views on how you have learnt to live and deal with their health with Parkinson's, the treatments and advice you have been given.*
- *There are no right and wrong answers, whatever you say will be helpful and allow us to get a better understanding of the issues. Please let me know if you find any issues distressing or if you do not wish to answer any question. If at any time you want to stop, or have a break, please feel free to let me know.*
- *Everything you tell me today will be kept confidential. I will be recording the interview, so I can remember all you have said to me.*
- *I would like to start by asking some general questions about (name of person), who has Parkinson's.*

General Questions about Parkinson's and health

1. How long have they been diagnosed with Parkinson's?
   How did they get diagnosed? Who did you see? How long did it take?
2. How did you get information about Parkinson's?
   How easy or difficult was it obtaining the information?
   How easy or difficult do you find understanding the information about Parkinson's?
3. Do they have other medical condition? What are they?
   Which of the medical conditions including Parkinson's do you consider to be the main issue at this moment?
4. What is your role in helping to support or care for *(name of person)?*
   Has this changed over time – *if yes, in what way?*

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5. What is the impact of your caring role on your life or social networks?

6. Do you feel overstretched with everything you have to do to help their Parkinson's?

Treatment Burden in Parkinson's

Thinking about (name of person with Parkinson's)…

7. Are there aspects of looking after their Parkinson's that you find difficult or challenging? What are they?

The following topics will be explored in an open fashion if appropriate, building on the response from participants to Question 6:

a. Do you **monitor** their Parkinson's? What do you do to monitor their Parkinson's? What aspects do you find difficult or challenging?

b. Do you help them with **medications and prescriptions**? What do you do? Are there any challenges with this? How many treatments/medications do they have?

c. Have you had any **financial** expenses associated with managing their Parkinson's? What was that for? Was there any help with that?

d. How many times have you seen **the GP** about their Parkinson's in the last 12 months? Tell me about your experiences with the GP. Can you tell me about your experiences with the GP before COVID?

e. How many **hospital appointments** have they had for their Parkinson's in the last 12 months? Tell me about your experiences at the hospital appointment. Can you tell me about your experiences with hospital appointments before COVID?

f. Have you had contact or access to **other healthcare services** (district nurses, physiotherapist, occupational therapist, speech therapist etc.)? How do you find attending all the appointments?

g. Have you had any issues **getting help at the weekends or overnight**? How did you find this experience?

8. What do you do if you have a **concern or question** about their Parkinson's? Tell me about your experiences of getting hold of your Parkinson's doctor/GP/nurse specialist/therapist. Was this different before COVID?

9. What are your thoughts about how your **care is coordinated** between all the health care professionals such as your GP, hospital doctors, therapists or specialist nurses? Have you had to do anything to resolve any issues or miscommunication?

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Capacity

10. What things have helped you deal with the issues you have mentioned earlier such as… ? *(remind them of issues that was mentioned from previous questions)*

11. Does *(name of person with Parkinson's)* have paid carers to help with their personal care?
If yes - how easy or difficult was to organise this? If no – why not?
Are you aware of where to get information about getting more help if needed?

12. How can the healthcare system be changed to help you manage their health with Parkinson's?

General Questions About the Caregiver

13. What about yourself, do you have any medical conditions? What are they?

14. What do you do to look after your own health?
Does this affect your ability to look after *(name of the person with Parkinson's)?*
Has helping to look after *(name of person with Parkinson's)* affected your own health?

15. Is there anything else you like to add?

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Interview Details

Subject ID:	
Date of Interview:	
Time of Interview:	
Interviewer:	

Participant Profile

1. Age:
2. Gender: ☐ Male ☐ Female
3. Relationship to person with Parkinson's:
4. Living arrangements: ☐ Alone
   ☐ With Spouse/partner/family/friend
   ☐ Other: _____
5. Ethnicity: ☐ White
   ☐ Asian/Asian British
   ☐ Black /African/Caribbean/Black British
   ☐ Mixed/Multiple ethnic groups
   ☐ Other (please specify) _____
6. Can you tell me if you went onto any further education after secondary school?

   ☐ No ☐ Yes (please describe: _____)
7. How does the Parkinson's affect the person with Parkinson's at present? (tick one box)
   ☐ No sign of disease
   ☐ Parkinson's symptoms on one side of the body
   ☐ Parkinson's symptoms on both sides of the body with no balance problems
   ☐ Mild to moderate Parkinson's symptoms on both sides of the body with some balance problems but still physically independent
   ☐ Severe disability but still able to walk or stand unassisted
   ☐ Wheelchair-bound or bedridden unless assisted

Close of the interview

Thank you for your time and participation. I would like to reassure you that everything you told me will be kept confidential and identified only by an identity number.

Appendix K Published interview article

PLOS ONE

RESEARCH ARTICLE

What are the modifiable factors of treatment burden and capacity among people with Parkinson's disease and their caregivers: A qualitative study

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Abstract

Background

People with long-term conditions must complete many healthcare tasks such as take medications, attend appointments, and change their lifestyle. This treatment burden and ability to manage it (capacity) is not well-researched in Parkinson's disease.

Objective

To explore and identify potentially modifiable factors contributing to treatment burden and capacity in people with Parkinson's disease and caregivers.

Methods

Semi-structured interviews with nine people with Parkinson's disease and eight caregivers recruited from Parkinson's disease clinics in England (ages 59–84 years, duration of Parkinson's disease diagnosis 1–17 years, Hoehn and Yahr (severity of Parkinson's disease) stages 1–4) were conducted. Interviews were recorded and analyzed thematically.

Results

Four themes of treatment burden with modifiable factors were identified: 1) Challenges with appointments and healthcare access: organizing appointments, seeking help and advice, interactions with healthcare professionals, and caregiver role during appointments; 2) Issues obtaining satisfactory information: sourcing and understanding information, and satisfaction with information provision; 3) Managing medications: getting prescriptions right, organizing polypharmacy, and autonomy to adjust treatments; and 4) Lifestyle changes:

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exercise, dietary changes, and financial expenses. Aspects of capacity included access to car and technology, health literacy, financial capacity, physical and mental ability, personal attributes and life circumstances, and support from social networks.

Conclusions

There are potentially modifiable factors of treatment burden including addressing the frequency of appointments, improving healthcare interactions and continuity of care, improving health literacy and information provision, and reducing polypharmacy. Some changes could be implemented at individual and system levels to reduce treatment burden for people with Parkinson's and their caregivers. Recognition of these by healthcare professionals and adopting a patient-centered approach may improve health outcomes in Parkinson's disease.

Introduction

Patients with long-term conditions and their caregivers must complete many daily tasks to manage their health. These tasks include taking multiple medications, attending appointments, searching for information, learning about their health condition, changing their dietary intake, and completing recommended exercises [1, 2]. This workload of healthcare and its impact on patient well-being and functioning is termed 'treatment burden' [2, 3]. Eton et al developed a framework of treatment burden which included three themes: 1) work patients must do to care for their health, 2) challenges or stressors that exacerbate perceived burden, and 3) impact of burden [2, 3]. The ability to manage treatment burden ('capacity') can be influenced by multiple factors including physical and mental ability, socioeconomic resources, health literacy and living situation [4–6]. People with high treatment burden or low capacity may have poor healthcare outcomes such as low adherence to treatment recommendations and poor quality of life [1].

Parkinson's disease (PD) is a common neurodegenerative condition worldwide with 6.1 million people living with PD in 2016 [7, 8]. People with Parkinson's (PwP) must manage an array of motor and non-motor symptoms including tremors, rigidity, slowness of movement, sleep disorders, fatigue, urinary and bowel dysfunction, depression, apathy, and psychosis [7, 9]. Management of PD primarily focuses on symptom control, often through multiple medications at different times each day [10]. Additionally, non-pharmacological treatments may be recommended in conjunction with pharmacological treatment in PD [11]. For example, exercise and physical activity supported by physiotherapists and appropriate referral to a multidisciplinary team including an occupational therapist, speech and language therapist or dietician can help manage the progressive symptoms of PD [12]. In a few patients with PD where optimal medical therapy fails to control their symptoms, neurosurgical procedures such as deep brain stimulation (DBS) may be appropriate [13].

Treatment burden and capacity among PwP and their caregivers have been little explored. A recent qualitative systematic review identified potential aspects of treatment burden in PD although none of the included studies specifically aimed to explore the treatment burden or capacity of PwP and caregivers. The review found managing medications, navigating healthcare obstacles at individual provider and system levels, and learning about health were the main aspects of treatment burden [14]. Therefore, this qualitative study aimed to explore the

experiences of treatment burden and capacity among PwP and their caregivers and identify potentially modifiable factors.

Materials and methods

The study was approved by the National Health Service Research Ethics Committee (21/WM/0058) and is registered on ClinicalTrials.gov (NCT04769973).

Participant recruitment and sampling

Participants were recruited from two PD specialist outpatient clinics in the South of England, United Kingdom (UK). Inclusion criteria were adults age >18 years with a diagnosis of PD, and/or self-identified caregiver of someone with PD. Exclusion criteria were those who were unable to consent to participate. Purposive sampling was conducted based on age, gender, the severity of PD, and caregiver relationship. Sampling to include patients with PD dementia and caregivers of someone with PD dementia was added after the interviews commenced to capture the potential impact of cognition on treatment burden and capacity experiences. Eligible participants were approached by a researcher (QYT) after their clinic appointment following their agreement with the PD specialist to discuss potential participation in the study. Participants were given a study pack containing a participant information sheet, a reply slip, and a free post envelope. Potential participants were given at least 24 hours to consider their participation and then contacted by QYT (1st author) to answer any questions and arrange an interview date for those interested. PwP were able to participate even if they did not have a caregiver. PwP who had a caregiver were able to participate on their own, and vice-versa. Thirty-two potential participants were invited and 17 (9 PwP and 8 caregivers) consented to participate.

Data collection

Two interview guides were developed (S1 File): one for the person with PD and one for the caregiver with similar questions on both. The interview guides were developed using Eton's framework of treatment burden, a review of published interview schedules from other qualitative studies of treatment burden and capacity conducted in patients with long-term conditions other than PD, and findings from a systematic review of treatment burden experiences in PD [2, 14–17]. The interview guides were reviewed by our patient and public involvement group (comprising one person with PD, one caregiver of someone with PD, and one caregiver of someone with dementia) which led to additional questions regarding care coordination and changes in question-wording for clarity. The guides were then piloted with two PwP and one caregiver before finalization to ensure ease of understanding and relevance of questions to their experiences of treatment burden and capacity.

One-to-one semi-structured interviews were conducted by QYT at a location and time convenient to participants between July to November 2021. Participants were offered face-to-face, telephone or online video interviews to ensure that data collection could be conducted despite the COVID-19 pandemic. Field notes were taken following each interview to capture initial reflections of treatment burden and capacity aspects within each specific context. The interviews lasted between 45–75 minutes and were audio recorded following written consent. Interviews were then transcribed verbatim by a research assistant and fully anonymized before data analysis.

Data analysis

Thematic analysis was conducted by QYT and KI (last author) [18]. Nvivo V12 software was used to organize codes and themes. Each transcript was read multiple times, and inductive line-by-line coding was conducted to generate a list of codes and themes alongside the interview field notes and participants' context including length of PD diagnosis, PD severity, and living situation. Discussions between QYT and KI defined and redefined the themes and subthemes to ensure that they reflected the data. This was an iterative process, with multiple diagrammatic mind maps created to visually identify any links and relationships between the themes and subthemes. The findings were further discussed with the research team.

Reflexivity

QYT is a female medical clinician who conducts regular PD clinics and completed this study as part of a postgraduate degree. None of the participants were known to QYT in a clinical setting before the study, and QYT introduced herself as a researcher at the start of each interview. Prior knowledge of Eton's framework of treatment burden may have influenced data analysis. However, data immersion, maintaining an inductive approach during coding, and multiple discussions between the research team aimed to reduce this potential bias.

Results

Seventeen participants (9 PwP, 8 caregivers) were interviewed, with 16 interviews conducted face-to-face and one conducted online. Participants were aged 59–84 years, with a duration of diagnosis 1–17 years and H&Y stages 1–4 (Table 1). All participants lived at home; 14 with a

Table 1. Participants' characteristics.

Study ID	Role	Sex	Age (years)	Length of PD diagnosis (years)	H&Y stage	Living situation	Caregiver relationship
P01	Patient	F	78	13	2	Alone	No caregiver
P02	Patient	M	84	3	3	Spouse	Wife
P03	Patient	M	78	1	3	Spouse	Wife
P04	Patient	F	79	10	4	Spouse	Husband
P05*	Patient	M	72	17	4	Spouse	Wife
P06	Patient	M	71	4	1	Spouse	Wife
P07	Patient	F	82	5	3	Alone	Daughter
P08	Patient	F	72	11	3	Spouse	No caregiver
P09†	Patient	M	72	4	3	Spouse	Wife
C01	Caregiver	F	78	1	3	Spouse	Wife
C02	Caregiver	F	73	9	3	Spouse	Sister
C03	Caregiver	M	70	10	4	Spouse	Husband
C04	Caregiver	F	70	13	3	Spouse	Wife
C05**	Caregiver	F	71	17	4	Spouse	Wife
C06	Caregiver	F	67	4	1	Spouse	Wife
C07	Caregiver	F	59	5	3	Alone	Daughter
C08††	Caregiver	F	73	4	3	Spouse	Wife

Caregiver of PwP; F, Female; M, Male; PD; Parkinson's Disease,

*Deep brain stimulation treatment,

**Caregiver of someone with deep brain stimulation treatment,

†, Diagnosed with PD dementia,

††Caregiver of someone with PD dementia

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spouse and three on their own. Two participants with PD did not have a caregiver. Caregivers included spouses, a sister, and a daughter of someone with PD. Four patient-caregiver couples participated in the interviews including one couple with DBS treatment and one couple with a diagnosis of PD dementia. On two occasions, it was impossible to interview the person with PD and their caregiver individually leading to occasional interruptions during the interviews.

Treatment burden

The main factors contributing to treatment burden identified are summarized in the following four themes: 1) Challenges with appointments and access to healthcare, 2) Issues obtaining satisfactory information regarding PD, 3) Managing prescriptions and medications, and 4) Personal lifestyle changes. The themes and subthemes with supportive quotes from participants are summarized in Table 2.

Theme 1: Challenges with appointments and access to healthcare. *Organizing routine healthcare appointments*. PwP and caregivers reported attending multiple appointments with various healthcare professionals for their PD such as a PD specialist doctor, PD nurse specialist, General Practitioner (GP), physiotherapist, occupational therapist, psychologist, speech and language therapist, and the older people's mental health team. Negotiating the system for arranging appointments and unexpected changes to planned appointments were reported as challenging for some participants and caused stress and frustration. Participants also described dissatisfaction with the frequency of PD appointments. A few participants preferred more frequent appointments with the PD team, whilst others felt that they had too many appointments which consequently had a negative impact on their personal and social activities. During the COVID-19 pandemic, PwP and caregivers reported cancelled or delayed appointments and telephone appointments rather than face-to-face appointments which contributed to treatment burden. The impact of PD on speech meant that PwP reported that their voices were not heard clearly over the telephone. Furthermore, they found it difficult to describe their PD symptoms and concerns and felt that they were unable to build rapport with healthcare professionals over the telephone.

Seeking help and advice from healthcare professionals. Most participants were able to get in touch with their PD specialist, PD nurse specialist, GP, or pharmacist when they had a concern about their PD. However, some participants reported difficulties accessing their GP due to the healthcare pressures and ten-minute appointment time slots which were insufficient to address their complex health needs with PD. The online GP electronic consultation service was difficult to use due to the slowness of movement and tremors in PD affecting the use of computers. Other participants reported hesitancy in seeking medical advice and chose not to seek help between their planned routine appointments with the PD team unless necessary. Reasons reported were not wanting to bother healthcare professionals, avoiding further tests or disruptions to their daily activities, trying to manage issues on their own by searching for information on the internet, and poor relationships with their GP.

Interactions with healthcare professionals. Most participants described that they were able to build trust and relationships with the PD team and that their concerns were listened to and addressed appropriately. Yet, a few participants reported that the lack of care continuity and lack of shared decision-making with healthcare personnel prevented this relationship building. Additionally, a few PwP and caregivers described poor relationships with their GP due to poor communication and continuity of care, a lack of empathy, and a lack of understanding about their health issues with PD.

Caregiver role during appointments and access to healthcare professionals. Caregivers played a key role in organizing and attending appointments including helping the person with PD

Table 2. Examples of participants' quotes of treatment burden in Parkinson's disease.

Themes	Subthemes	Issues of Treatment Burden	Supportive Quotes
Theme 1: Challenges with appointments and access to healthcare professionals	Organizing routine healthcare appointments	Attending multiple healthcare appointments Negative impact of COVID-19 on quality and frequency of appointments	*"As far as I'm concerned, it's just one more bl**dy visit to medics of some sort. You know, by the time you've gone to the dentist, opticians, consultants for my eyes, and I've got to go and see the doctor about this, it's probably skin cancer. It's nearly always something on that means I have to go out and spend time doing stuff when I might just like to finish reading my book from the library." P08* *"I still think I'd prefer face-to-face, cos I think body language is a big sign about things. And you can get a better rapport with somebody you're sitting with, rather than this digital." P06*
	Seeking help and advice from healthcare professionals	Methods of contacting healthcare professionals Hesitancy in seeking medical advice Difficulty in accessing GPs for advice	*"And, because I'm very slow and I keep on hitting the wrong button because I'm shaking, so, it's a nuisance to use it (online electronic consultation)." P08* *"Most of it I leave, and I think it will be alright tomorrow sort of thing. But then, if it's quite a while (daughter) says, 'You've gotta do such and such a thing'. She might say, 'Get in touch with the doctor or the nurse or something. Find out what is happening.'" P07* *"It took me a couple of days to get through to them (GP) because they have a different system. If you want such and such press this and if you want, then you're on the phone and waiting and waiting and waiting. I'm waiting my life away, you know." C02*
	Interactions with healthcare professionals	Care coordination between healthcare services Continuity of care and building relationships with healthcare professionals	*"Anything they (PD specialist) send to my GP they seem to ignore. I don't think they even read the letters. I get no reaction from GP at all." P05* *"I used to have a GP, she retired about 3 years ago. And when she was my GP, which she was for about 20 years, she got to know me, I got to know her, and she was a person I went to see. Nowadays, no one doctor knows me. I don't like that." P08*
	Caregiver role during appointments and access to healthcare professionals	Help communicate and raise issues with healthcare professionals Reminding PwP of the outcomes from healthcare appointments Contacting healthcare professionals on behalf of PwP	*"And I've generally gone along with (husband) to his consultation meetings. And, you know, (PD specialist) was very good because she allowed me at times to talk." C04* "So, I sat in on her (physiotherapy) sessions because mum, unfortunately, is forgetting things now, so I can remind her, yes." C07 *"I was thinking about setting in a care plan and having to deal with doctors, that was the first thing, dealing with the doctors and the medication. And then the council, the frailty team, the nurses that were dealing with him." C02*
Theme 2: Issues obtaining satisfactory information regarding PD	Sources of information	Receiving and signposting to information Searching for information Learning from personal and other people's experiences	*"Consultant said to me, 'if you want my advice, learn as much as you can about PD. Read everything you can, try and find the association and learn everything you can so you can make informed choices about your treatment and medication and things like that'. So, I followed his advice." P05* *"And the other stuff, I just learn on the hoof, because we asked (PD specialist) what to expect and the bottom line is that no one person is the same with PD so he couldn't tell us exactly what to expect. So, he wasn't going to frighten us with stuff that could happen but might not happen. So, I think that was the best way round." C03*
	Understanding information and satisfaction with levels of information provided	Understanding information provided Poor levels of information provided Personal preference for information related to PD	*"I have a fair idea about what might happen to me Parkinson's wise so I can generally tell whether something is or isn't. And if I'm not sure, I don't bother to know, I get on with my life." P08* *"They didn't say, well this is going to happen; that might happen this, they didn't do any of that. They just said, 'yes (husband) you've got Parkinson's, thank you very much'." C06* *"So, the information is out there, it's whether you want it or not. I know several people who don't want to know, whereas I did want to know, and I still want to know." P01*

(*Continued*)

Table 2. (Continued)

Themes	Subthemes	Issues of Treatment Burden	Supportive Quotes
Theme 3: Managing prescriptions and medications	Getting prescriptions right	Errors in prescriptions Collecting prescriptions	*"I've probably taken 20 minutes running between the pharmacy and the GP, where the GP said something, well via the receptionist, cos you can never see the GP. And then you go back to the pharmacy, and they say 'right, right medication, the right prescription should have come through now', cos they've sent the wrong prescription for whatever reason. And um, you get to the pharmacy, and they say, 'it's not come through, it must be in the ether somewhere'." C07*
	Managing polypharmacy and its impact on PwP and caregivers	Taking multiple medications at different times Approaches to help medication taking Monitoring response to treatment and impact of missed medications	*"I'm managing fine except it takes me at least half an hour in the morning to put them together cos I have I think it's about 19 tablets. And it's then that I think, get the tablets container. It says to take one three times a day say, so I get three out, put them in some things where they've gotta go, read it up make sure it's the right one, and I'm over checking myself all the time." P07* *"Suddenly she gets up from the chair and finds she can't walk to the door cos everything's stopped. You know, and that's just the effect of, so yes it does make a difference. Yes, we have been late, but that's when she's really late taking (medications)." C07*
	Autonomy to adjust treatments	Seeking advice from healthcare professionals Taking control of PD treatments	*"He started by three a day, and then it went up to four, and then when we saw (PD specialist) last year, he said if he can tolerate having another one twice a day, do it so it's like he's having six a day now." C08* *"I very cheekily altered the (medication) times with what, I don't know who it was, did it for me because they didn't suit me, so I altered them." P01*
Theme 4: Personal lifestyle changes	Exercising and keeping active	Attending physiotherapy and exercise classes Maintaining physical activity	*"I did go through all the exercises and that with the nurses up there, and I did them quite well. But now, most of the time I'm too weak to do them. Like if I feel weak and I can't be doing it, when I'm feeling better, I want to catch up on something I can do." P07* *"I don't want to eat and put on a lot of weight because that wouldn't be good. That's why I like walking to keep as active as I can." P02*
	Dietary changes	Maintaining healthy diet Changes in diet due to PD medications and symptoms	*"I try and be careful what I'm eating. Certain things I try and avoid it if I'm doing anything that requires going out as it interferes with the absorption of Ropinirole. Like cheese, I love cheese, but it blocks the Ropinirole. So that's out now." P05* *"I don't drink, I never go to the pubs or anything. I'm on these pills, why mix it with alcohol? I'm taking pills for a purpose, why interfere with that." P02*
	Financial expenses related to health	Expenses for travel to appointments, equipment, mobility aids, lifestyle changes, and practical support for daily activities	*"We've got a bigger shower now. A walk-in shower and aids for (husband). So, we had to have the fourth bedroom smaller to make a really big bathroom for him." C05*

C; Quote from caregiver, GP; General Practitioner, P; Quote from person with PD; Parkinson's Disease, PwP; People with Parkinson's

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communicate with healthcare professionals due to speech difficulties in PD, prompting them to discuss symptoms and medication issues, raising additional issues they have noticed, and reminding the person with PD who had memory issues of the outcomes or management changes following appointments. They also reported accessing and contacting healthcare professionals and city councils on behalf of the person with PD to discuss medication issues or arrange a suitable care plan.

Theme 2: Issues obtaining satisfactory information regarding PD. *Sources of information*. Participants reported receiving information from multiple sources following the diagnosis of PD including healthcare professionals, Parkinson's UK (a Parkinson's research and support national charity), family members, or searching for information themselves on the internet. A few participants reported that they were encouraged by their PD specialist doctors and nurses to learn as much as possible about PD such as learning about PD symptoms, medications, and the impact on driving and insurance. Many participants described learning how to manage their health with PD from personal experiences and talking to other PwP and caregivers by attending Parkinson's local support groups as they felt that healthcare professionals

were unable to tell them what to expect. However, a few participants reported that seeing others with more advanced stages of PD reminded them of the potential future deterioration that could happen to them. Some participants reported wanting to know as much information as possible as it helped ease their concerns and manage their PD. Others preferred not to know more than necessary to avoid worrying about the future. It appears their personal preferences about information levels may change over time. For example, one participant with PD searched for much information regarding PD after her initial diagnosis and reported that after 11 years of living with PD she now feels that she has enough information and prefers not to search further.

Understanding information and satisfaction with levels of information provided. Some participants were unhappy with the level of information provision, particularly about the potential symptoms of PD, possible worst-case scenarios, prognosis, and long-term future with PD. Caregivers also described poor information on how to care for someone with PD. Out of desperation and uncertainty, some PwP and caregivers searched for information themselves on ways to manage the symptoms of PD, medication side-effects or devices to help with medication adherence using the internet or by going to the library even though they did not particularly want to. PwP and caregivers also described that the information provided could be confusing and difficult to understand, particularly the medical terms used. Poor explanation from healthcare professionals about the diagnosis and possible causes of PD as well as the potential prognosis led to PwP and caregivers feeling unsupported and unable to manage their health with PD.

Theme 3: Managing prescriptions and medications. *Getting prescriptions right.* Participants experienced errors in medication prescriptions due to miscommunications between the PD specialist, GP, and pharmacy which were difficult to resolve. A few participants also reported delays in obtaining prescription changes and delays in getting prescriptions ready, resulting in occasions when not all medications were dispensed which may be detrimental to the management of PD. Some PwP were able to order their prescriptions online and collect their prescriptions from the pharmacy. However, other PwP relied on their caregivers or friends to complete this task as they were unable to use a computer themselves due to tremors, had poor memory, and experienced mobility issues due to PD.

Managing polypharmacy and its impact on PwP and caregivers. Taking multiple medications at different times each day to manage PD and other long-term conditions such as hypertension, diabetes, hypercholesterolemia, and asthma were challenging for some participants. A few participants also reported the negative impact of medications for other health conditions on their PD, such as experiencing dizziness and low blood pressure exacerbated by medications to treat hypertension. Due to the polypharmacy, PwP and caregivers reported that they had to be vigilant when reading medication names and instructions on the prescriptions to avoid any errors or confusion. Organizing medications was described as time-consuming, and one participant with PD reported that it took up to 30 minutes to do so daily. Some participants accepted that despite the tiresome work of taking many medications, the noticeable positive response of PD symptoms meant they realized that taking PD medications was a necessity and made sure not to miss any doses. Others reported persisting with PD medications despite a lack of improvement in PD symptoms and not noticing any difference with missed or delayed medications. However, the strict adherence to the multiple PD medications timings throughout the day was reported as preventing PwP and caregivers from doing their usual activities. Some PwP also described difficulties managing the varying effects of PD medications on a day-to-day basis as well as experiencing medication side-effects such as hallucinations, depression, irritability, and anxiety.

Participants described approaches to managing polypharmacy such as routinising medication-taking into their daily activities, writing down medication schedules, and using different pill devices and technology such as alarms on an iPad® or reminders on the Alexa® device. Nevertheless, difficulties with fine movements and memory issues due to PD meant that some PwP reported being unable to manage medications on their own. Consequently, caregivers described managing medications by removing medications from packaging, laying medications out during mealtimes, and reminding them of medication times. Moreover, issues with swallowing as PD progressed meant that a few participants described learning new ways of managing medications such as dissolving PD medications in water and using a straw.

Autonomy to adjust treatments. Treatment changes could be challenging for PwP and caregivers. One participant with DBS reported multiple adjustments of the DBS device voltage settings, requiring regular six-weekly appointments to achieve adequate PD symptom control. Some PwP reported that they always sought advice from their PD team for any adjustments in PD medications doses and timings but were given final autonomy to make any decisions after considering the benefits and side-effects of medication changes. In contrast, other PwP took control of their medications and changed their medication timings to fit around their planned personal activities despite the instructions on prescriptions. One participant with PD and caregiver discussed any medication changes between themselves and weighed up the potential impact of medication changes.

Theme 4: Personal life adaptations. *Exercising and keeping active.* Most PwP and caregivers described trying to keep physically active by walking or gardening as recommended by healthcare professionals. Some participants reported that they were referred for physiotherapy and were given exercises to help improve balance, walking, ability to stand from a chair and appropriate use of mobility equipment aids. However, some PwP did not notice any difference in their symptoms and were unsure if exercise was helpful. A few PwP with mid-to-late stages of PD stated that they were unable to complete the exercises due to symptoms of fatigue and weakness and chose to prioritize other activities when they felt able to. Due to the COVID-19 pandemic, a few participants noticed a deterioration in the mobility of the person PD as they were not able to be as physically active due to the closure of leisure centres, lack of exercise classes, and not going out for walks due to concerns about contracting COVID-19.

Dietary changes. Some participants described maintaining a healthy diet with fresh fruit and vegetables and ensuring a stable weight. Other PwP reported avoiding certain food and drinks such as alcohol or cheese by choice, as they found from experience that it exacerbated PD symptoms such as tremors and interfered with PD medications which consequently affected their mobility and ability to carry out daily activities. Swallowing and dexterity issues meant that a few participants described a change to softer meals, and a need for caregivers to cut the food into smaller pieces for the person with PD.

Financial expenses related to health. Due to the progression and impact of PD symptoms on mobility, some PwP and caregivers described the financial expenditure for equipment and mobility aids such as a shower stool, shower rails, walker, trolley, or wheelchair to help their mobility, maintain independence and allow them to leave the house for activities. Difficulties completing activities of daily living due to PD symptoms also meant that some participants reported paying for private carers, a cleaner, a gardener, or the delivery of meals to help them manage this. A few participants reported personal home renovations to increase accessibility for the person with PD, adding to the costs of managing their health with PD.

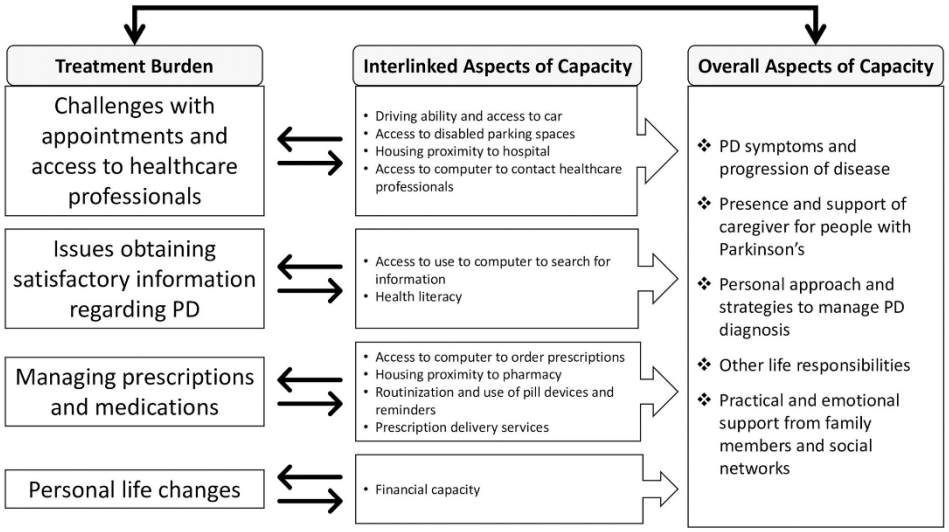

Fig 1. Interlinked and overall aspects of treatment burden and capacity in Parkinson's disease.

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Capacity

There were aspects of capacity for PwP and caregivers that specifically related to the issues of treatment burden in PD described in the four themes above as well as the overall capacity of PwP and caregivers (Fig 1). For example, aspects of capacity that enabled PwP and caregivers to get to hospitals for their healthcare appointments were their ability to drive, access a car, and access to disabled parking spaces. The proximity of their homes to the hospital and pharmacy and ease of public transport also helped them access these services. Searching for information and understanding the information related to PD were supported by their health literacy levels, family members, personal life circumstances and experiences. Access and ability to use a computer enabled PwP and caregivers to get in touch with healthcare professionals, search for information and order prescriptions from the pharmacy. The management of prescriptions and polypharmacy for PwP and caregivers were supported by routinization of medication taking into everyday activities, use of pill devices or reminders and prescription delivery services. Furthermore, having greater financial resources enhanced participants' capacity to complete personal life adaptations such as attending private exercise classes, maintaining dietary changes, purchasing equipment or mobility aids and obtaining additional practical support for activities of daily living.

Additionally, other aspects contributed to the overall capacity of PwP and caregivers to manage the treatment burden (Table 3). Firstly, the **presence and support from caregivers** was an important aspect of capacity for someone with PD. Caregivers assisted PwP with accessing healthcare services, managing medications and prescriptions, and helping with understanding of the information provided. Both PwP and caregivers reported the importance of maintaining a strong relationship with each other by ensuring honesty, open communications and working together. Secondly, many participants described their **personal attributes**

Table 3. Examples of participants' quotes of overall aspects of capacity in Parkinson's disease.

Overall Aspects of Capacity	Supportive Quotes
Presence and support from caregivers	*"I rely upon my family. My memory for going back a long way before I retired and things like that, um, is still quite good. Now, if I'm talking to you sort of thing, I forget where I get to. As I say, it's infuriating the polite way of putting it. But I rely upon my family." P09* *"Well, he will take the wrong tablet at the wrong time, um, and you say to him, 'you know, what happened there?'. I mean, even now, with his timer box he's got. Sometimes it'll go off and he'll go out to the kitchen, um, and I think he gets a drink and gets lost and takes a drink and doesn't take tablets. So, I'm always having to look in the little box to check." C08*
Personal attributes and life circumstances	*"I think the good thing was I accepted it from the beginning cos I knew there was something wrong and, with the Lord's help I was able to knuckle to and sort myself out and make the most of it." P04* *"I suppose I have no alternative. You have to get on with it; you have to try and manage it the best you can. I think fatigue's the hardest thing, because if you're fatigued you can't do anything, or you feel you can't do anything. Sometimes you have to push yourself." P06*
Practical and emotional support from family members and social networks	*"I have surrounded myself with help so, although once COVID came she stopped doing my hair and I found out how to do it myself. So, I did have a hairdresser; I have a gardener; I have a cleaner; I have a window cleaner." P01* *"We (neighbors) all know each other so if you get into a fix like when (wife) fell in the garden and I had to go and get help to try and get her up, and our church home group is very good as well." C03*

C; Quote from caregiver, P; Quote from person with PD; Parkinson's Disease

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and life circumstances that affected their ability to manage PD. Maintaining a positive attitude, a strong sense of independence, a sense of humor, being level-headed and taking each day as it comes helped PwP and caregivers accept the diagnosis, progression, and impact of PD. A few participants also reported the importance of faith and religion in helping them accept the challenges of PD and making the most of their lives. Some PwP and caregivers reported that other life responsibilities such as work, household maintenance and caring responsibilities for elderly parents or grandchildren could impact their ability to manage the treatment burden. Finally, most participants reported the invaluable practical, emotional, and psychological **support from family members and wider social networks** such as friends, neighbors, church members, and local Parkinson's UK support groups. Sharing experiences with other people in the same situation, support getting to exercise classes and hospital appointments along with help with activities of daily living such as washing, dressing, cooking, and gardening not only helped PwP who lived alone, but also other PwP and caregivers manage the healthcare tasks in PD.

Discussion

This qualitative study has for the first time explored the experiences of treatment burden and capacity in PD. High treatment burden among PwP and caregivers related to challenges organizing and attending multiple appointments, poor access, and interactions with healthcare professionals, difficulties obtaining satisfactory levels of information related to PD, managing prescriptions and medications, and enacting personal life adaptations. Aspects of capacity for PwP and caregivers included driving ability, access to car and technology, living proximity to

amenities, health literacy, financial capacity, personal attributes, and availability of support from family members and social networks. The symptoms and progression of PD such as tremors, poor dexterity, swallowing problems, fatigue and poor memory were reported to impact their ability to manage medications, access healthcare services and complete recommended exercises. This may result in increased treatment burden or reduced capacity in PwP and caregivers. Indeed, treatment burden and capacity appear to be closely interlinked in PD as seen in Fig 1. This aligns with the Cumulative Complexity Model and Burden of Treatment Theory which describes the dynamic relationship and interaction between patient workload and capacity, and the important interactions of social networks including healthcare professionals with this structural model [4, 19].

This study has identified the potentially modifiable factors that could reduce treatment burden or enhance capacity in PD. For instance, rather than offering follow-up appointments for PD at routine intervals, a move towards patient-initiated follow-up appointments where patients or caregivers have control over their follow-up care as recommended by National Health Service (NHS) England in 2020 could address the dissatisfaction with frequency of appointments voiced by PwP and caregivers [20]. However, whilst the benefits of patient-initiated follow-up appointments have been shown in other health conditions such as breast cancer, inflammatory bowel disease and rheumatoid arthritis, it's use in PD remains uncertain [21]. Furthermore, poor interactions and relationships between PD service users and healthcare professionals may be improved through specific training strategies that enhance communication and interpersonal skills of healthcare professionals. This could potentially ensure better patient-centered communication and reduce treatment burden [22, 23]. Aligning appointments, improving access, care coordination, and continuity of care between primary and secondary healthcare services through development and implementation of integrated care models for PD may also improve the treatment burden experiences for PwP and caregivers [24, 25]. Furthermore, tailored information provision by healthcare professionals based on personal preferences and stages of PD and structured medication reviews either by GP, PD specialist or pharmacists to reduce polypharmacy and frequency of medication timings could also be beneficial [26, 27].

Likewise, patient capacity may be enhanced such as improving health literacy through the appropriate provision of information in various modes that are easily accessible to PwP and caregivers, structured education sessions for PwP and caregivers and effective communication from healthcare professionals [26, 28, 29]. Encouraging self-management and change in personal approaches to PD by healthcare professionals or capacity coaching could help PwP and caregivers draw on existing sources of capacity or cultivate new strategies of managing a long-term condition such as PD [30, 31]. Healthcare professionals could signpost PwP and caregivers to information regarding medication aids as a simple way to increase utilization of practical strategies such as pill devices and prescription delivery services to help medication burden. These recommendations for change at individual provider and system levels could improve the treatment burden experiences for PwP and caregivers. However, further research is required to determine the effectiveness of the proposed changes in PD.

Our interview findings align and add to the systematic review that reported the main contributors to treatment burden in PD relate to medications, healthcare obstacles at individual and system levels and information provision [14]. Additional factors relating to prescription errors, medication availability, collecting prescriptions, and issues with access to GP are reported in our study. These issues were also reported in UK studies of treatment burden in patients with other long-term conditions, including stroke and chronic kidney disease [15, 17]. Furthermore, difficulties understanding information were reported by PwP and caregivers, with factors such as previous occupation and family support affecting their ability to

understand health-related information. Awareness of PwP and caregivers' personal preferences for information can help healthcare professionals ensure information provision and explanation at the appropriate level. Studies in patients with multiple long-term conditions in the UK and multimorbid patients with cardiovascular disease in Denmark have found that low health literacy was associated with high treatment burden levels [32, 33]. Therefore, health literacy may be an important and potentially modifiable aspect of capacity as highlighted in our findings [4].

The COVID-19 pandemic may have had an impact on the treatment burden in PD due to necessary changes in healthcare delivery leading to delayed or cancelled appointments and poor experiences with telephone appointments reported by PwP and caregivers. This is in line with findings from a large Parkinson's UK national survey that reported that 34% of respondents had appointments with the PD specialist or PD nurse specialist cancelled during the pandemic, whilst more than half were not offered a telephone or online appointment [34]. Negative experiences with telephone appointments were also reported in other studies with PwP [35, 36]. However, a recent implementation study conducted in Canada reported that the use of virtual visits in primary care may reduce treatment burden related to medical appointments and monitoring health status [37]. Therefore, the use of telemedicine as an adjunct or additional service for clinicians may be beneficial to some PwP with severe disability, homebound or those living in rural areas who have access to internet-enabled devices through reduced travel time and costs [36, 38].

Caregivers and social networks have an important role in supporting someone with PD. The presence of a caregiver was a fundamental aspect of patient capacity and managing treatment burden for the PwP in this study. This is increasingly important due to the progressive PD symptoms. Caregivers themselves experienced treatment burden by attending appointments, managing medications, learning about PD, and enacting lifestyle changes together with the person with PD they support. Caregivers managed this treatment burden on top of providing physical, social, and emotional support, as well as assisting with personal care and activities of daily living [39, 40]. Moreover, some caregivers of PwP may themselves be diagnosed with a long-term condition and have to manage their own health [41]. This can be demanding and contribute to caregiver burden, a well-researched yet separate concept defined as "the extent to which caregivers perceive that caregiving has had an adverse effect on their emotional, social, financial, physical and spiritual functioning" [42, 43]. Although our findings have highlighted caregivers' invaluable role in managing the health of someone with PD, treatment burden amongst caregivers of people with long-term conditions remains understudied [44]. A systematic review of qualitative studies reported that caregivers of patients with chronic obstructive pulmonary disease (COPD) experienced increasing accumulation of treatment burden as the disease progressed with functional deterioration of the person with COPD [45]. This aligns with our study findings that report the impact of increasing symptoms and inevitable progression of PD on the treatment burden and capacity in both PwP and caregivers. In particular, the presence of cognitive impairment and dementia may mean that the person with PD may no longer be able to manage the treatment burden themselves, relying instead on their caregiver to complete the workload of health [46].

Strength and limitations

A strength of this study is the use of purposive sampling which led to the inclusion of participants with a range of characteristics including those with mild, moderate, and severe PD who have been living with PD over a wide range of years. Whilst the inclusion of participants living with DBS treatment and PD dementia, spousal and non-spousal caregivers who were both

cohabiting or lived separately from the PwP is a further strength of this study, the small number of participants representing each characteristic mean that not all experiences of treatment burden may have been captured. However, there were several limitations. Firstly, this study was conducted in the UK with a publicly funded national health system and the findings may not apply to PwP and caregivers in other countries with different health systems, although they are likely to experience similar challenges worldwide [14]. Secondly, there was a lack of ethnic diversity among participants which may limit the transferability of the findings, although this aligns with the local population of the study region. Thirdly, data regarding financial capacity or deprivation levels were not collected and these factors may influence the experiences of participants. Although reasons for not participating were not recorded, eligible participants with PD who did not respond to the study invitation were aged 67–87 years old, diagnosed with PD between 1–23 years, living alone or cohabiting, with or without a caregiver, and two PwP who had early cognitive impairment. Whilst these were similar characteristics to participants recruited in this study, participants with high treatment burden or less capacity may not have consented to participate in the interviews due to the limited time constraints in their everyday lives trying to manage their PD. Therefore, there may be other aspects of treatment burden and capacity not reported in the findings.

Implications and next steps

PwP and their caregivers may experience one or more aspects of treatment burden. Therefore, it is crucial to identify which aspects may be most burdensome to allow targeted person-centered interventions to optimize the treatment burden. Achieving patient-centered care for PwP and caregivers through 'Minimally Disruptive Medicine' by developing and implementing flexible models of healthcare system delivery which comprehensively address patient complexity and optimizes healthcare intervention may be helpful [1, 6]. However, a recent systematic review of quantitative interventional studies in adults with long-term conditions reported that only 11 articles evaluated the impact of medical interventions on patient-reported treatment burden [47]. Reduction in medication dosing frequency or providing medical devices that were easier to use in patients with diabetes, the addition of background medication in patients with cystic fibrosis and offering home phototherapy in patients with psoriasis had positive outcomes on treatment burden. Yet, the review reported that only three studies assessed treatment burden as a primary endpoint, and these were all in patients with diabetes. Therefore, further research is needed to evaluate strategies and interventions at both individual and system levels to reduce treatment burden in PD. Whilst several measures such as the Multimorbidity Treatment Burden Questionnaire, Treatment Burden Questionnaire and the Patient Experience with Treatment and Self-Management have been developed to measure treatment burden in long-term conditions, none of these have been validated in PD [48–50]. Determining the extent of treatment burden in PD may help healthcare professionals and researchers determine the factors associated with high treatment burden to target specific interventions or change for PwP and caregivers who may be at risk of poor health outcomes.

Conclusions

There are potentially modifiable factors that can be implemented by PwP, caregivers, healthcare professionals and healthcare services that may reduce the treatment burden or enhance capacity of PwP and caregivers. Treatment burden and capacity are closely interlinked in PD. Recognition of this by healthcare professionals and adopting a patient-centered approach could improve the experiences of managing PD for PwP and caregivers. This may lead to better health outcomes for those affected by PD.

Supporting information

S1 File. Interview guides.
(PDF)

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Appendix L Survey for PwP

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The PD Life Study Survey: Living with Parkinson's

If you would prefer to complete this survey online, go to:
https://www.smartsurvey.co.uk/s/F1L768/

Before starting the survey, please read the participant information sheet included in the study pack. This survey is designed to find out about **your experiences of living with Parkinson's** and other long-term health conditions.

Please answer the questions as they relate to **you and your own health with Parkinson's**. Try to answer each question as best as you can. You may ask for help from your friends or family. You can complete the survey in stages if you wish to. If you are not able to complete the whole survey, answering as many questions as you can would still be helpful.

If you need extra help completing the survey or have any questions, please contact the research team (Dr Qian Tan on 07824 895 791; email q.tan@soton.ac.uk) who will be able to help you.

Where you are required to select an option, please tick the box: ☑

Unless otherwise stated, please only tick one answer for each question.

Once you have completed the survey, **please return it by post using the freepost envelope**. If you would like a summary of the study results, please complete the 'Study Results' information form and return this together with your survey. You can also choose to complete the information form online. Thank you for taking part in this study.

Please tick this box to confirm that you have read the participant information sheet and are consenting to participate in this study: ☐

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Section One: About You

1. **How old are you (years)?**

   ☐

2. **What is your sex?**
   ☐ Male
   ☐ Female
   ☐ Prefer not to say

3. **What is your ethnic group**?
   ☐ White
   ☐ Asian/Asian British
   ☐ Black /African/Caribbean/Black British
   ☐ Mixed/Multiple ethnic groups
   ☐ Other (please specify) _____

4. **How would you describe your current marital status?**
   ☐ Single (never married or in a civil partnership)
   ☐ Married or in a civil partnership
   ☐ Divorced or dissolved civil partnership
   ☐ Widowed

5. **How would you describe your current living situation (most of the time)?**
   ☐ I live alone
   ☐ With spouse or partner
   ☐ With another family member(s)
   ☐ With friend(s)
   ☐ Other (please specify) _____

6. **What property do you currently live in?**
   ☐ Own property
   ☐ Rented property
   ☐ A relative's home
   ☐ A friend's home
   ☐ Care home (residential or nursing home)

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Section One: About You (continued)

7. **How would you best describe the area that you currently live in?**
   ☐ Urban
   ☐ Suburban
   ☐ Rural

8. **What is the first part of your postcode?** ***(please leave the last two letters out; e.g. if your postcode is AA55 1BB then answer as AA55 1)***

   ☐☐☐☐ - ☐■■

9. **What is your current employment status?**
   ☐ Employed (full or part time)
   ☐ Unemployed
   ☐ Retired
   ☐ Other (please specify) _____

10. **Have you given up a full time or part time job because of your Parkinson's?**
    ☐ Yes
    ☐ No

11. **What is your highest education level obtained?**
    ☐ Degree level or above
    ☐ A level or equivalent
    ☐ GSCE level or equivalent
    ☐ No qualification
    ☐ Other qualification (please specify) _____

12. **How would you describe your usual access to a car?**
    Please tick the closest description:
    ☐ I have a car that I can drive
    ☐ I can regularly travel (as a passenger or driver) in someone else's car
    ☐ I have little or no access to a car
    ☐ I no longer drive due to my Parkinson's

13. **How would you describe your usual access to technology (smartphone, tablet, laptop and/or computer)?**
    Please tick the closest description:
    ☐ I have access to technology that I can use regularly
    ☐ I have access to technology, but I need help using it
    ☐ I have little or no access to technology

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Section Two: Looking After Your Health

We are interested in finding out about the effort you have to make to look after your health and how this impacts on your day-to-day life.

Please tell us how much difficulty you have with the following:

(Please tick the box that most applies to you)

	Extremely Difficult	Very Difficult	Quite Difficult	A little Difficult	Not Difficult	Does not apply
1. Taking lots of medications	☐	☐	☐	☐	☐	☐
2. Remembering how and when to take medication	☐	☐	☐	☐	☐	☐
3. Paying for prescriptions, over the counter medication or equipment	☐	☐	☐	☐	☐	☐
4. Collecting prescription medication	☐	☐	☐	☐	☐	☐
5. Monitoring your medical conditions (e.g. checking your blood pressure or blood sugar, monitoring your symptoms etc.)	☐	☐	☐	☐	☐	☐
6. Arranging appointments with health professionals	☐	☐	☐	☐	☐	☐
7. Seeing lots of different health professionals	☐	☐	☐	☐	☐	☐
8. Attending appointments with health professionals (e.g. getting time off work, arranging transport etc.)	☐	☐	☐	☐	☐	☐
9. Getting health care in the evenings and at weekends	☐	☐	☐	☐	☐	☐
10. Getting help from community services (e.g. physiotherapy, district nurses etc.)	☐	☐	☐	☐	☐	☐
11. Obtaining clear and up-to-date information about your condition	☐	☐	☐	☐	☐	☐
12. Making recommended lifestyle changes (e.g. diet and exercise etc.)	☐	☐	☐	☐	☐	☐
13. Having to rely on help from family and friends	☐	☐	☐	☐	☐	☐

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Section Three: Your Parkinson's and Health

1. **How many years have you had Parkinson's?**

   ☐

2. **How does your Parkinson's affect you?**
   ☐ No sign of disease
   ☐ Parkinson's symptoms on one side of the body
   ☐ Parkinson's symptoms on both sides of the body with no balance problems
   ☐ Mild to moderate Parkinson's symptoms on both sides of the body with some balance problems but still physically independent
   ☐ Severe disability but still able to walk or stand unassisted
   ☐ Wheelchair-bound or bedridden unless assisted

3. **Do you have a named Parkinson's nurse specialist?**
   ☐ Yes
   ☐ No
   ☐ I am not sure

4. **How easy or difficult is it to get in touch with your Parkinson's nurse specialist if you had a question or concern about your Parkinson's?**
   ☐ Very easy
   ☐ Easy
   ☐ Neither easy nor difficult
   ☐ Difficult
   ☐ Very difficult
   ☐ I have not needed to get in touch with my Parkinson's nurse specialist

5. **Where do you get information about your Parkinson's?**
   (Please tick all that apply)
   ☐ GP
   ☐ Parkinson's specialist doctor
   ☐ Parkinson's nurse specialist
   ☐ Parkinson's UK website
   ☐ Parkinson's UK support group
   ☐ Online search
   ☐ Other people with Parkinson's
   ☐ Other caregivers of someone with Parkinson's
   ☐ I prefer not to search for information
   ☐ Other (please specify) _____

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Section Three: Your Parkinson's and Health (continued)

6. **How easy or difficult is it to get information about Parkinson's?**
   - ☐ Very easy
   - ☐ Easy
   - ☐ Neither easy nor difficult
   - ☐ Difficult
   - ☐ Very difficult

7. **Do you feel you have enough information about Parkinson's?**
   - ☐ No, but I *would like* to know more
   - ☐ No, but I *choose not* to know more
   - ☐ Yes, I have enough information
   - ☐ Yes, but I feel I have too much information

8. **How often do you need someone to help you when you read instructions, pamphlets, or other written material from your doctor or pharmacy?**
   - ☐ Never
   - ☐ Rarely
   - ☐ Sometimes
   - ☐ Often
   - ☐ Always

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Section Three: Your Parkinson's and Health (continued)

9. **Other than your Parkinson's, please list down all your other health conditions (e.g. high blood pressure, diabetes, arthritis etc.) if you have any: -**

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Section Four: Your Parkinson's Symptoms

NON-MOVEMENT PROBLEMS IN PARKINSON'S

The movement symptoms of Parkinson's are well known. However, other problems can sometimes occur as part of the condition or its treatment. It is important that the doctor knows about these, particularly if they are troublesome for you.

A range of problems is listed below. Please tick the box 'Yes' if you have experienced it **during the past month**. If you have **not** experienced the problem in the past month tick the 'No' box. You should answer 'No' even if you have had the problem in the past but not in the past month.

Have you experienced any of the following in the last month?

	Yes	No
1. Dribbling of saliva during the day time	☐	☐
2. Loss or change in your ability to taste or smell	☐	☐
3. Difficulty swallowing food or drink or problems with choking	☐	☐
4. Vomiting or feelings of sickness (nausea)	☐	☐
5. Constipation (less than 3 bowel movements a week) or having to strain to pass a stool (faeces)	☐	☐
6. Bowel (faecal) incontinence	☐	☐
7. Feeling that your bowel emptying is incomplete after having been to the toilet	☐	☐
8. A sense of urgency to pass urine makes you rush to the toilet	☐	☐
9. Getting up regularly at night to pass urine	☐	☐
10. Unexplained pains (not due to known conditions such as arthritis)	☐	☐
11. Unexplained change in weight (not due to change in diet)	☐	☐
12. Problems remembering things that have happened recently or forgetting to do things	☐	☐
13. Loss of interest in what is happening around you or doing things	☐	☐
14. Seeing or hearing things that you know or are told are not there	☐	☐
15. Difficulty concentrating or staying focussed	☐	☐
16. Feeling sad, 'low' or 'blue'	☐	☐
17. Feeling anxious, frightened or panicky	☐	☐
18. Feeling less interested in sex or more interested in sex	☐	☐
19. Finding it difficult to have sex when you try	☐	☐
20. Feeling lightheaded, dizzy or weak standing from sitting or lying	☐	☐
21. Falling	☐	☐
22. Finding it difficult to stay awake during activities such as working, driving or eating	☐	☐
23. Difficulty getting to sleep at night or staying asleep at night	☐	☐
24. Intense, vivid dreams or frightening dreams	☐	☐
25. Talking or moving about in your sleep as if you are 'acting' out a dream	☐	☐
26. Unpleasant sensations in your legs at night or while resting, and a feeling that you need to move	☐	☐
27. Swelling of your legs	☐	☐
28. Excessive sweating	☐	☐
29. Double vision	☐	☐
30. Believing things are happening to you that other people say are not true	☐	☐

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Section Five: Your Medications

1. **Please list down <u>ALL</u> the medications (prescribed and over the counter) that you take for your Parkinson's and/or other health conditions:-**

	Medication Name and Dose	Frequency
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		

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Section Five: Your Medications (continued)

2. **Does anyone help you with your medications?**
   ☐ Yes
   ☐ No

3. **In total, how many different times a day do you need to take your medications?**

4. **Are you prescribed any medication that requires you to inject yourself?**
   ☐ Yes
   ☐ No

5. **Do you use any of the following to help you remember to take your medications?** ***(Please tick all that apply)***
   ☐ Dosette box/ pill box
   ☐ Medication timers
   ☐ Phone reminders
   ☐ I have someone who helps remind me
   ☐ I do not need reminders
   ☐ Other (please specify) _____

6. **How do you manage your prescriptions?**
   ☐ I collect my medications from the pharmacy
   ☐ I have someone who helps me collect medications from the pharmacy
   ☐ My medications are delivered to my home
   ☐ Other (please specify) _____

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Section Six: Your Use of Healthcare Services

1. ***In the last 12 months*, how many times have you had contact or accessed the following healthcare professionals <u>for your Parkinson's</u>** *(this includes all face-to-face, telephone or video appointments, home visits or other methods)*:

   a) Parkinson's specialist doctor? ☐

   b) Parkinson's nurse specialist? ☐

   c) Physiotherapist? ☐

   d) Occupational therapist? ☐

   e) Speech and language therapist? ☐

   f) Dietician? ☐

   g) Older People Mental Health team? ☐

   h) GP? ☐

2. ***In the last 12 months,* how many times have you had contact or accessed your <u>GP</u> for anything else <u>other than your Parkinson's</u>?** ☐

3. ***In the last 12 months*, how many times have you been to the <u>hospital in an emergency</u>?** ☐

4. ***In the last 12 months*, how many times have <u>paramedics</u> attended your home?** ☐

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Section Seven: You and Your Health

1. **Have you felt overstretched by everything you've had to do to manage your health in the last month (e.g. taking medications, getting prescriptions, attending appointments) ?**
   ☐ Yes
   ☐ No

2. **In general, do you have any health problems that require you to limit your activities?**
   ☐ Yes
   ☐ No

3. **In general, do you have any health problems that require you to stay at home?**
   ☐ Yes
   ☐ No

4. **Do you regularly use a stick, walker, or wheelchair to get about?**
   ☐ Yes
   ☐ No

5. **If you need help, can you count on someone close to you?**
   ☐ Yes
   ☐ No

6. **Do you need someone to help you on a regular basis?**
   ☐ Yes
   ☐ No

7. **Who is the main person who helps or supports you on a regular basis?**
   ☐ Spouse/Partner
   ☐ Family member
   ☐ Friend(s)
   ☐ I do not have/need anybody to help me
   ☐ Other (please specify) _____

8. **Do you have a paid carer(s) that help with your personal care?**
   ☐ Yes
   ☐ No

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Section Eight: Your Health and Well-Being

Your Health and Well-Being

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. ***Thank you for completing this survey!***

For each of the following questions, please tick the one box that best describes your answer.

1. **In general, would you say your health is:**

Excellent	Very good	Good	Fair	Poor
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

2. **The following questions are about activities you might do during a typical day. Does <u>your health now limit you</u> in these activities? If so, how much?**

	Yes, limited a lot	Yes, limited a little	No, not limited at all
a Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	☐ 1	☐ 2	☐ 3
b Climbing several flights of stairs	☐ 1	☐ 2	☐ 3

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Section Eight: Your Health and Well-Being (continued)

3. During the <u>past 4 weeks</u>, how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of your physical health</u>?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a <u>Accomplished less</u> than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b Were limited in the <u>kind</u> of work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

4. During the <u>past 4 weeks</u>, how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of any emotional problems</u> (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a <u>Accomplished less</u> than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b Did work or other activities <u>less carefully than usual</u>	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

5. During the <u>past 4 weeks</u>, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

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Section Eight: Your Health and Well-Being (continued)

6. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks…

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a Have you felt calm and peaceful?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b Did you have a lot of energy?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c Have you felt downhearted and low?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

7. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Thank you for completing these questions!

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End of Survey

Thank you for completing this survey.

If you would like a summary of the study results, please complete the 'Study Results' form in your study pack and return the form together with the survey using the freepost envelope or complete the form online at: tinyurl.com/PDLifeResults

Please return the survey by post using the freepost envelope available in your study pack.

Appendix M Survey for Caregiver

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The PD Life Study Survey: Caring for Someone with Parkinson's

If you would prefer to complete this survey online, go to:
https://www.smartsurvey.co.uk/s/FJOMVS/

Before starting the survey, please read the participant information sheet included in the study pack. This survey is designed to find out about **your experiences of providing care, assistance, or support for someone with Parkinson's**.

Please answer the questions as they relate to **you or the person with Parkinson's you care for** as stated at the start of each section in the survey. Try to answer each question as best as you can. You may ask for help from your friends or family. You can complete the survey in stages if you wish to. If you are not able to complete the whole survey, answering as many questions as you can would still be helpful.

If you need extra help completing the survey or have any questions, please contact the research team (Dr Qian Tan on 07824 895 791; email q.tan@soton.ac.uk) who will be able to help you.

Where you are required to select an option, please tick the box: ☑

Unless otherwise stated, please only tick one answer for each question.

Once you have completed the survey, **please return it by post using the freepost envelope**. If you would like a summary of the study results, please complete the 'Study Results' information form and return this together with your survey. You can also choose to complete the information form online. Thank you for taking part in this study.

Please tick this box to confirm that you have read the participant information sheet and are consenting to participate in this study ☐

Please tick this box to confirm that you help to support or care for someone with Parkinson's ☐

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Section One: About You

The questions in this section are about ***you*** as someone who looks after someone else with Parkinson's. Please fill in ***your own*** details, not the details of the person with Parkinson's.

1. **How old are you (years)?**

   [ ]

2. **What is your sex?**
   - ☐ Male
   - ☐ Female
   - ☐ Prefer not to say

3. **What is your ethnic group?**
   - ☐ White
   - ☐ Asian/Asian British
   - ☐ Black/African/Caribbean/Black British
   - ☐ Mixed/Multiple ethnic groups
   - ☐ Other (please specify) _____

4. **How would you describe your current marital status?**
   - ☐ Single (never married or in a civil partnership)
   - ☐ Married or in a civil partnership
   - ☐ Divorced or dissolved civil partnership
   - ☐ Widowed

5. **What is your relationship to the person with Parkinson's that you support and care for on a regular basis?**
   - ☐ Spouse/Partner
   - ☐ Family member
   - ☐ Friend(s)
   - ☐ Other (please specify) _____

6. **How would you describe your current living situation (most of the time)?**
   - ☐ I live alone
   - ☐ With spouse or partner
   - ☐ With another family member(s)
   - ☐ With friend(s)
   - ☐ Other (please specify) _____

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Section One: About You (continued)

7. **What property do you currently live in?**
   - ☐ Own property
   - ☐ Rented property
   - ☐ A relative's home
   - ☐ A friend's home
   - ☐ Care home (residential or nursing home)

8. **How would you best describe the area that you currently live in?**
   - ☐ Urban
   - ☐ Suburban
   - ☐ Rural

9. **What is the first part of your postcode?** ***(please leave the last two letters out; e.g. if your postcode is AA55 1BB then answer as AA55 1)***

   ☐☐☐☐ - ☐■■

10. **What is your current employment status?**
    - ☐ Employed (full or part time)
    - ☐ Unemployed
    - ☐ Retired
    - ☐ Other (please specify) _____

11. **Have you given up a full time or part time job to help support or care for the person with Parkinson's?**
    - ☐ Yes
    - ☐ No

12. **What is your highest education level obtained?**
    - ☐ Degree level or above
    - ☐ A level or equivalent
    - ☐ GSCE level or equivalent
    - ☐ No qualification
    - ☐ Other qualification (please specify) _____

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Section One: About You (continued)

13. **How would you describe your usual access to a car?**
Please tick the closest description:
☐ I have a car that I can drive
☐ I can regularly travel (as a passenger or driver) in someone else's car
☐ I have little or no access to a car

14. **How would you describe your usual access to technology (smartphone, tablet, laptop and/or computer)?**
Please tick the closest description:
☐ I have access to technology that I can use regularly
☐ I have access to technology, but I need help using it
☐ I have little or no access to technology

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Section Two: Looking After the Health of the Person You Care For

The questions in this section are about ***you*** as someone who looks after someone else with Parkinson's. Please fill in ***your own*** details, not the details of the person with Parkinson's.

We are interested in finding out about the effort **you** have to make to help look after the health of someone with Parkinson's and how this impacts on your day-to-day life.

Please tell us how much difficulty you have with helping the person you care for with the following: (Please tick the box that most applies to you)

	Not difficult	A little difficult	Quite difficult	Very difficult	Extremely difficult	Does not apply
1. Taking lots of medications	☐	☐	☐	☐	☐	☐
2. Remembering how and when they need to take their medication	☐	☐	☐	☐	☐	☐
3. Paying for their prescriptions, over the counter medication or equipment	☐	☐	☐	☐	☐	☐
4. Collecting their prescription medication	☐	☐	☐	☐	☐	☐
5. Monitoring their medical conditions (e.g. checking their blood sugar, monitoring symptoms etc)	☐	☐	☐	☐	☐	☐
6. Arranging their appointments with health professionals	☐	☐	☐	☐	☐	☐
7. Seeing lots of different health professionals	☐	☐	☐	☐	☐	☐
8. Attending appointments with health professionals (e.g. getting time off work, arranging transport etc)	☐	☐	☐	☐	☐	☐
9. Getting health care for them in the evenings and at weekends	☐	☐	☐	☐	☐	☐
10. Getting them help from community services (e.g. physiotherapy, district nurses etc)	☐	☐	☐	☐	☐	☐
11. Obtaining up-to-date information about their medical conditions	☐	☐	☐	☐	☐	☐

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	Not Difficult	A Little Difficult	Quite Difficult	Very Difficult	Extremely Difficult	Does Not Apply
12. Making recommended changes to their lifestyle (e.g. diet, exercise etc)	☐	☐	☐	☐	☐	☐
13. Having to rely on help from family and friends	☐	☐	☐	☐	☐	☐
14. Arranging respite care for the person you care for	☐	☐	☐	☐	☐	☐
15. The financial impact of being a carer (e.g. having to give up work, relying on benefits etc)	☐	☐	☐	☐	☐	☐
16. Adjusting your own lifestyle so that you can look after the person you care for	☐	☐	☐	☐	☐	☐

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Section Three: You and Your Health

The questions in this section are about ***you*** as someone who looks after someone else with Parkinson's. Please fill in ***your own*** details, not the details of the person with Parkinson's.

1. **Have you felt overstretched by everything you've had to do to help manage their health in the last month (e.g. taking medications, getting prescriptions, attending appointments)?**
   ☐ Yes
   ☐ No

2. **In general, do you have any health problems that require you to limit your activities?**
   ☐ Yes
   ☐ No

3. **In general, do you have any health problems that require you to stay at home?**
   ☐ Yes
   ☐ No

4. **Do you regularly use a stick, walker, or wheelchair to get about?**
   ☐ Yes
   ☐ No

5. **If you need help, can you count on someone close to you?**
   ☐ Yes
   ☐ No

6. **Do you need someone to help you on a regular basis?**
   ☐ Yes
   ☐ No

7. **Do you have a paid carer(s) that helps you with your personal care?**
   ☐ Yes
   ☐ No

8. **Does helping to look after someone with Parkinson's affect your own health?**
   ☐ Yes
   ☐ No

9. **Does your own health affect how you look after someone with Parkinson's?**
   ☐ Yes
   ☐ No

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Section Three: You and Your Health (continued)

10. **Please list down all <u>your</u> health conditions (e.g. high blood pressure, diabetes, arthritis etc.) if you have any:-**

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Section Four: Caring for Someone with Parkinson's

The questions in this section are about ***you*** as someone who looks after someone else with Parkinson's. Please fill in ***your own*** details, not the details of the person with Parkinson's.

INSTRUCTIONS: The following is a list of statements, which reflect how people sometimes feel when taking care of another person. After each statement, indicate how often you feel that way: never, rarely, sometimes, quite frequently, or nearly always. There are no right or wrong answers.

'Relative' in this section refers to your spouse/partner/family/friend with Parkinson's that you help to care for.

	Never	Rarely	Sometimes	Quite Frequently	Nearly Always
1) Do you feel that because of the time you spend with your relative you don't have enough time for yourself?	☐	☐	☐	☐	☐
2) Do you feel stressed between caring for your relative and trying to meet other responsibilities for your family or work?	☐	☐	☐	☐	☐
3) Do you feel angry towards your relative when you are around him/her?	☐	☐	☐	☐	☐
4) Do you feel that your relative currently affects your relationship with other family members or friends in a negative way?	☐	☐	☐	☐	☐
5) Do you feel strained when you are around your relative?	☐	☐	☐	☐	☐
6) Do you feel your health has suffered because of your involvement with your relative?	☐	☐	☐	☐	☐
7) Do you feel that you don't have as much privacy as you would like because of your relative?	☐	☐	☐	☐	☐
8) Do you feel that your social life has suffered because you are caring for your relative?	☐	☐	☐	☐	☐
9) Do you feel you have lost control of your life since your relative's illness?	☐	☐	☐	☐	☐
10) Do you feel uncertain about what to do about your relative?	☐	☐	☐	☐	☐
11) Do you feel you should be doing more for your relative?	☐	☐	☐	☐	☐
12) Do you feel you could do a better job in caring for your relative?	☐	☐	☐	☐	☐

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Section Five: Obtaining Information About Parkinson's

The questions in this section are about ***you*** as someone who looks after someone else with Parkinson's. Please fill in ***your own*** details, not the details of the person with Parkinson's.

1. **Where do you get information about Parkinson's?**
   (Please tick all that apply)
   ☐ GP
   ☐ Parkinson's specialist doctor
   ☐ Parkinson's nurse specialist
   ☐ Parkinson's UK website
   ☐ Parkinson's UK support group
   ☐ Online search
   ☐ Other people with Parkinson's
   ☐ Other caregivers of someone with Parkinson's
   ☐ I prefer not to search for information
   ☐ Other (please specify) _____

2. **How easy or difficult is it to get information about Parkinson's?**
   ☐ Very easy
   ☐ Easy
   ☐ Neither easy nor difficult
   ☐ Difficult
   ☐ Very difficult

3. **Do you feel you have enough information about Parkinson's?**
   ☐ No, but I *would like* to know more
   ☐ No, but I *choose not* to know more
   ☐ Yes, I have enough information
   ☐ Yes, but I feel I have too much information

4. **How often do you need someone to help you when you read instructions, pamphlets, or other written material from your doctor or pharmacy?**
   ☐ Never
   ☐ Rarely
   ☐ Sometimes
   ☐ Often
   ☐ Always

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Section Six: About Their Parkinson's and Health

The questions in this section are about ***the person you care for with Parkinson's.*** Please fill in ***their*** details, not your own details.

1. **How many years have they had Parkinson's?**

   ☐

2. **How does their Parkinson's affect them?**
   ☐ No sign of disease
   ☐ Parkinson's symptoms on one side of the body
   ☐ Parkinson's symptoms on both sides of the body with no balance problems
   ☐ Mild to moderate Parkinson's symptoms on both sides of the body with some balance problems but still physically independent
   ☐ Severe disability but still able to walk or stand unassisted
   ☐ Wheelchair-bound or bedridden unless assisted

3. **Do they have a named Parkinson's nurse specialist?**
   ☐ Yes
   ☐ No
   ☐ I am not sure

4. **How easy or difficult is it to get in touch with their Parkinson's nurse specialist if you had a question or concern about their Parkinson's?**
   ☐ Very easy
   ☐ Easy
   ☐ Neither easy nor difficult
   ☐ Difficult
   ☐ Very difficult
   ☐ I have not needed to get in touch with the Parkinson's nurse specialist

5. **Does the person you care for with Parkinson's also have a paid carer who helps them with personal care?**
   ☐ Yes
   ☐ No

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Section Six: About Their Parkinson's and Health (continued)

6. ***In the last 12 months*, have you noticed any problems with their <u>mood</u>?**
   ☐ Yes
   ☐ No

7. ***In the last 12 months*, have you noticed any problems with their <u>memory</u>?**
   ☐ Yes
   ☐ No

8. ***In the last 12 months*, have you noticed if they experienced any <u>hallucinations</u>?**
   ☐ Yes
   ☐ No

9. **Do you support the person with Parkinson's with their medications?**
   ☐ Yes
   ☐ No
   ☐ They do not need help with taking medications

10. **How does the person with Parkinson's manage their prescriptions?**
    ☐ They collect their own medications from the pharmacy
    ☐ I collect their medications from the pharmacy
    ☐ Their medications are delivered to the home
    ☐ Other (please specify) _____

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Section Six: About Their Parkinson's and Health (continued)

11. **Please list down <u>ALL</u> the medications (prescribed and over the counter) that they take for their Parkinson's and any other health conditions:-**

	Medication Name and Dose	Frequency
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		

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Section Six: About Their Parkinson's and Health (continued)

12. **Other than their Parkinson's, please list down all their other health conditions (e.g. high blood pressure, diabetes, arthritis etc.) if they have any: -**

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Section Seven: Their Use of Healthcare Services

The questions in this section are about ***the person you care for with Parkinson's.*** Please fill in ***their*** details, not your own details.

1. ***In the last 12 months,*** **how many times have they had contact or accessed the following healthcare professionals for their Parkinson's** *(this includes all face-to-face, telephone or video appointments, home visits or other methods)*:

   a) Parkinson's specialist doctor? ☐

   b) Parkinson's nurse specialist? ☐

   c) Physiotherapist? ☐

   d) Occupational therapist? ☐

   e) Speech and language therapist? ☐

   f) Dietician? ☐

   g) Older People Mental Health team? ☐

   h) GP? ☐

2. ***In the last 12 months,*** **how many times have they had contact or accessed their GP for anything else other than their Parkinson's?** ☐

3. ***In the last 12 months*****, how many times have they been to the hospital in an emergency?** ☐

4. ***In the last 12 months*****, how many times have paramedics attended their home?** ☐

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Section Eight: Your Health and Well-Being

Your Health and Well-Being

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. ***Thank you for completing this survey!***

For each of the following questions, please tick the one box that best describes your answer.

1. In general, would you say your health is:

Excellent	Very good	Good	Fair	Poor
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

2. The following questions are about activities you might do during a typical day. Does <u>your health now limit you</u> in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
a Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	☐ 1	☐ 2	☐ 3
b Climbing several flights of stairs	☐ 1	☐ 2	☐ 3

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Section Eight: Your Health and Well-Being (continued)

3. During the <u>past 4 weeks</u>, how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of your physical health</u>?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a <u>Accomplished less</u> than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b Were limited in the <u>kind</u> of work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

4. During the <u>past 4 weeks</u>, how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of any emotional problems</u> (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a <u>Accomplished less</u> than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b Did work or other activities <u>less carefully than usual</u>	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

5. During the <u>past 4 weeks</u>, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

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Section Eight: Your Health and Well-Being (continued)

6. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks…

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a Have you felt calm and peaceful?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b Did you have a lot of energy?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c Have you felt downhearted and low?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

7. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Thank you for completing these questions!

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End of Survey

Thank you for completing this survey.

If you would like a summary of the study results, please complete the 'Study Results' form in your study pack and return the form together with the survey using the freepost envelope or complete the form online at: tinyurl.com/PDLifeResults

Please return the survey by post using the freepost envelope available in your study pack.

Appendix N One Page Summary of Findings for Focus Group Participants

PD Life

University of Southampton

The PD Life Study

Improving the Treatment Burden in Parkinson's

During the focus group, we will be discussing ways to improve the experiences of people with Parkinson's (PwP) and their caregivers as they try to look after their health (treatment burden). In our national survey with PwP and caregivers, more than half of the participants reported experiencing medium or high treatment burden. The main issues that they reported are summarised on this page. It would be helpful if you could think of ways to improve this.

Attending appointments and accessing healthcare professionals

- Organising and arranging healthcare appointments can be difficult for PwP and their caregivers. Some people were unhappy with the frequency of follow-up Parkinson's appointments.
- Due to COVID-19, appointments were conducted by telephone instead of face-to-face. Many PwP and caregivers found telephone appointments difficult and were unable to build a relationship with healthcare professionals.
- PwP and caregivers reported unsatisfactory interactions with healthcare professionals due to poor communication, lack of understanding, and lack of empathy.
- There was a lack of coordination between different healthcare teams.
- At times, it was difficult to get in touch with healthcare professionals for help or advice.

Getting satisfactory levels of information related to Parkinson's

- PwP and caregivers reported dissatisfaction with the levels of information provided (too much or not enough). Some information was confusing and difficult to understand without help.
- Other people reported searching the internet for information about Parkinson's which can be distressing due to large amount of information available.

Managing prescriptions and medications

- Some PwP and caregivers reported issues related to their prescriptions including errors and difficulty collecting them from the pharmacy.
- Most PwP and caregivers reported taking multiple medications at different times of the day. This can be difficult to remember leading to missed doses and may have an impact on their daily activities.
- There were frequent changes in Parkinson's medication doses and timings to control their symptoms which can be difficult to manage.

Appendix O Focus Group Guide

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FOCUS GROUP GUIDE: Exploring ways to reduce the treatment burden and enhance capacity of people with Parkinson's and their caregivers

Introduction from Researcher

1. Give complete name
2. Introduce self as researcher from Academic Geriatric Medicine at the University of Southampton.
3. Give short explanation about the study and purpose of the interview, check understanding or questions.
4. Discuss confidentiality and confirm consent for audio recording.

- *Thank you for agreeing to participate in this focus group as part of the PD Life Study.*
- *You all have an important role in the care of people with Parkinson's, either as someone who has been diagnosed with Parkinson's, as the family or friend that supports of care for someone with Parkinson's, healthcare professional, volunteer, policy maker or manager.*
- *We will use the term 'caregiver' to refer to the person who helps to support and care for someone with Parkinson's in the discussion today.*
- *The term 'treatment burden' is used to describe the effort and day-to-day tasks required to look after the health of people living with a long-term condition such as Parkinson's. This include taking medication, attending appointments, learning about Parkinson's and lifestyle changes such as diet and exercise. The ability to manage these demands is known as 'capacity'.*
- *The focus group today will discuss some of the key issues that impact the treatment burden and capacity in people with Parkinson's and their caregivers. The issues discussed today were gathered from previous stages of the PD Life Study.*
- *The aim of the focus group today is to develop recommendations of ways that we can improve the treatment burden in Parkinson's.*
- *You were all invited to participate as you have an important role in the care of people with Parkinson's.*

Guidelines/Ground Rules

- *There are no right or wrong answers, only differing points of view.*
- *Please use the 'Raise Hand' button during the discussion.*
- *We ask that you respect each other and listen respectfully even if you disagree with what they are saying. Talk to each other and discuss your views. Your point of view is important. My role as moderator will be to guide the discussion.*
- *We ask that you turn off your phones if possible. If you cannot and you must respond to a call, please put the microphone on mute and re-join us as quickly as you can. If you need a short break to take your medications or need a comfort break, please let me know.*
- *We will be recording the conversation today.*

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Introduction

- *Firstly, I would like everyone to introduce themselves. Please could you tell us how you would like to be called and what your role is in the care of Parkinson's.*
- *Before we start our discussion, I will give a briefly summarise the main issues of treatment burden and capacity that people with Parkinson's and their caregivers experience. The issues relate to attending appointments and accessing health professionals, getting satisfactory levels of information related to Parkinson's and managing prescriptions and medications.*
- *We will then discuss ways to improve each issue in turn.*

Discussion

Issues that have been found to impact the treatment burden in Parkinson's:

1. **Attending healthcare appointments and interactions with healthcare professionals:**
   - Organising and arranging healthcare appointments were reported to be difficult for PwP and caregivers. At times, unexpected changes to their appointments may be stressful to some people.
     - *How can we improve this?*
   - The national guideline for Parkinson's recommends 6-monthly follow-up appointments. However, PwP and caregivers report dissatisfaction with the frequency of follow-up appointments for their Parkinson's. Some preferred more frequent appointments, whilst others did not.
     - *What do you think might help?*
     - *Are patient's preferences considered when arranging follow-up PD appointments? Should it be?*
   - Due to COVID-19, many healthcare appointments were changed to telephone appointments and continue to be conducted. Yet, some PwP and caregivers report that that they preferred appointments in person due to hearing or speech issues, difficulty describing symptoms over the phone and inability to build rapport with healthcare professionals.
     - *How can we improve this?*
   - The lack of care coordination between different healthcare teams such as between GP and PD specialist, or between hospital and GPs was an issue of treatment burden.
     - *What can be done to improve this?*
   - Difficulties with contacting healthcare professionals for help and advice was reported as an issue of treatment burden in Parkinson's.
     - *How could this be better?*
2. **Information provision**
   - Getting the right levels of information at the right time, and understanding the information provided was another issue of treatment burden in Parkinson's.

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- *What do you think about the level of information provided regarding Parkinson's?*
- *What could make this better?*

- PwP and caregivers searched for information online themselves. The amount of information that may not be related to their own situation can be distressing.
  - *How could this be better?*

3. **Management of Medications and Prescriptions**
   - Prescription errors between GPs, PD specialists and pharmacist when there was change in medications were reported. This can be difficult for PwP and caregivers to solve.
     - *How can we improve this?*

   - Collecting prescriptions from the pharmacist can be difficult for some PwP and caregivers. Not everyone could rely on someone to collect their prescriptions for them, or had access to delivery services.
     - *What do you think might help?*

   - Issues related to remembering when to take medications and frequent changes in medication doses or timings appear to be an issue of treatment burden in Parkinson's.
     - *How could this experience be improved?*

Issues that impact people's capacity to manage treatment burden in Parkinson's:

- Caregivers have an important role in supporting someone with Parkinson's manage their health and activities of daily living. Our research reports that 50% of caregivers experience high treatment burden levels.
  - *How can we improve the experiences of caregivers?*

- Are there other things that impact on the ability of PwP and their caregivers to look after their health?

- Can you think of other ways to help PwP and their caregivers manage their overall health with Parkinson's?

Closing

- Is there anything we haven't asked that you think should be mentioned?
- Final thoughts and reflection.
- We ask that you keep this discussion here today confidential. Thank you for your time and participation in the PD Life Study.
- We will send you a summary of the study results if you have agreed to receive this at the end of the study.

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