

A Systematic Review

Falls Self-Management Interventions for People with Parkinson's Disease: A Systematic Review

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Abstract.

Background: Falls are common in Parkinson's disease (PD). Increased involvement of people with Parkinson's (PwP) in their care has been associated with enhanced satisfaction. Self-management programmes in other long-term conditions (LTCs) have led to improvements in physical and psychological outcomes. These have been more effective when targeted toward a specific behavior.

Objective: This paper aimed to identify and review falls self-management interventions for PwP.

Methods: A systematic review was conducted. Electronic databases were searched in June 2018. Primary research studies (any design) reporting the delivery of falls self-management interventions to PwP were included. Data was extracted from each article and synthesised narratively.

Results: Six articles were identified, relating to five different self-management interventions. All described a self-management intervention delivered alongside physiotherapy. Intervention delivery was through either group discussion ($n=3$) or falls booklets ($n=3$). Interventions were often incompletely described; the most common components were information about the condition, training/ rehearsal for psychological strategies and lifestyle advice and support. Arising from the design of articles included the effects of self-management and physiotherapy could not be separated. Three articles measured falls, only one led to a reduction. Four articles measured quality of life, only one led to improvement. No articles assessed skill acquisition or adherence to the self-management intervention.

Conclusions: Few falls self-management interventions for PwP have been evaluated and reported. The components of an effective intervention remain unclear. Given the benefits of self-management interventions in other LTCs, it is important that falls self-management interventions are developed and evaluated to support PwP.

Keywords: Accidental falls, parkinson's disease, patient education as topic, review, self care

INTRODUCTION

Falls are common in Parkinson's disease (PD), with two thirds of people with Parkinson's (PwP)

falling each year compared to one third of the general older population [1]. Falling often leads to a fear of falling and a decline in physical activity, which is associated with negative outcomes including a decline in both physical function and quality of life (QOL) [2, 3]. Falling in PD is multifactorial; specific risk factors include freezing of gait and postural instability but recurrent falls are more likely among those with cognitive impairment [4, 5]. The preva-

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lence of cognitive impairment rises with increasing patient age and disease duration but mild dysfunction has been reported in 24% of newly diagnosed PwP [6, 7]. The majority of PwP live in their own homes helped by family members, ‘informal caregivers’, who provide vital physical, emotional, and social support [4, 8]. Caregivers of PwP often feel unprepared and unsupported in this role, and the onset of falling has been associated with increased caregiver burden [9, 10].

Systematic reviews of physiotherapy interventions for falls have reported inconclusive results, which may relate to the nature of the studies included. These reviews have been based upon studies of predominantly low-moderate methodological quality with heterogeneity of interventions and outcomes measured [11–13]. One recent systematic review conducted by Shen et al. reported a reduction in fall rate, however, the effect size was small and outcomes from individual studies were mixed [12]. Whereas, earlier reviews conducted by Allen et al. and Tomlinson et al., reported no effect of physiotherapy on fall rate or the proportion of fallers respectively [11, 13]. In Shen et al. the greatest benefits were observed in association with facility based training [12]. By design, these studies may exclude PwP with greater disease severity or cognitive impairment, as travel may be more difficult. Rehabilitative interventions may be less effective in those with more advanced PD, for whom falling is more common [14]. Similarly, in a recent large multi-centre randomized controlled trial (RCT), a four month high-intensity structured exercise programme did not lead to improvements in fall rate or QOL in people with mild to moderate dementia or their caregivers [15].

The review of physiotherapy interventions by Tomlinson et al. reported a lack of effect on both fear of falling and quality of life [11]. Whilst a review of occupational therapy based interventions for PwP reported a positive short-term effect on QOL, this was based upon the results of three small studies [16]. This finding was not replicated in two subsequent large RCTs of occupational therapy; in these studies the majority of participants had mild-moderate PD, the very group in whom rehabilitative interventions have been proposed to be more effective [14, 17, 18].

PwP and their caregivers have expressed a wish for increased involvement and participation in their care, which has been associated with enhanced patient satisfaction [8, 19, 20]. Self-management has been proposed as a potential strategy to help PwP and their

caregivers to identify and address problems relating to how PD affects them [21]. Self-management can be broadly defined as increased responsibility or confidence of an individual in managing a long-term condition (LTC) [22]. Self-management programmes in LTCs such as diabetes, stroke, and chronic obstructive pulmonary disease have led to improvements in physical and psychological outcomes [23–27]. Similarly, promoting active patient engagement, has been shown to be cost effective by improving quality of care and medical outcomes in older patients with multimorbidity [28].

The majority of self-management programmes are based on Bandura’s self-efficacy theory which hypothesises that an individual’s self-perceived ability to perform a task, or to manage a situation, is directly related to their subsequent likelihood of success [22]. For an individual to self-manage a LTC they might require training in medical, behavioral, and emotional techniques. Arising from the heterogeneity of falls in PD, PwP and their caregivers are likely to differ in what they require to for effective self-management [4, 5]. Important factors might be knowledge of the contributing risks to falls and skills and confidence in how to modify them, and understanding when and who to contact if difficulties arise.

A 2017 integrative review of self-management programmes for PwP to support any aspect of PD concluded that there was insufficient evidence to support their effectiveness [29]. Following self-efficacy theory, self-management programmes in other LTCs have been more effective when targeted toward a specific behavior as opposed to providing generic advice and support [22, 30]. In this paper we aimed to systematically identify and review falls self-management interventions for PwP, and if possible, assess their efficacy for improving patient and caregiver outcomes, QOL and psychological outcomes. Such information will be beneficial to inform the development of falls self-management interventions for PwP in research and routine clinical practice.

MATERIALS AND METHODS

This review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines [31]. The review protocol was registered on PROSPERO, CRD42017052585.

Searching strategy and identification of articles

Searches were conducted in June 2018. Searches aimed to locate all papers relating to self-management in PD. A sensitive and inclusive searching strategy using Medical Subject headings (MeSH) and key free text terms pertaining to (i) PD and (ii) self-management was developed. Animal studies were excluded and the search was limited to studies published since the emergence of the concept of self-management within the literature (1986 onwards) [23]. The search terms were developed in MEDLINE and adapted for use in EMBASE, CINAHL, AMED, PSYCHInfo and Science Citation Index Expanded (Web of Science) (for details about search terms used see Supplementary Table 1). Given the heterogeneity of interventions that may support self-management in LTCs, we did not stipulate that authors needed to use the term ‘self-management’ [23–26]. The search strategy contained no falls-related terms to allow identification of studies where falling was only discussed in the full text. Additional searches were made in clinical trials registers. The grey literature was searched at www.opengrey.eu.

Articles were eligible for inclusion where they reported interventions aimed to improve falls self-management in PwP. Studies were included regardless of design. A broad definition of self-management was used; studies that aimed to increase the responsibility or confidence of PwP in managing falls. Articles were excluded where the intervention consisted of physiotherapy alone.

Multi-modal interventions were included where one component aimed to support self-management of falling. No restrictions on language were applied.

After removal of duplicates, article titles were screened by CO for relevance. CO and KI independently screened all abstracts for eligibility. Full texts of all potentially relevant articles were reviewed for relevance and discrepancies were resolved through mutual discussion. Reference lists of relevant articles were screened. Figure 1 depicts the search results and inclusion/exclusion process.

Data analysis and assessment of study quality

Self-management programmes are often complex and multi-faceted. Complex interventions are comprised of multiple interacting components, with additional dimensions to include heterogeneity of those delivering or receiving the intervention [32].

In the wider LTC literature, inadequately detailed reporting of the content and delivery of complex interventions, and the lack of a shared *language for describing their components*, has been identified as a barrier to drawing clear conclusions about what works and why and to wider implementation [33–35]. The ‘Practical Reviews in Self-management Support’ (PRISMS) taxonomy was used to characterize the self-management component of each intervention [33]. This tool (Table 1) details 14 components that a self-management programme might contain and has successfully been used to identify the key features of self-management interventions to support patients with diabetes, heart failure, asthma, chronic obstructive pulmonary disease, and cancer [26, 28].

CO extracted data from the selected articles into a predefined database, with all content confirmed by KI. Authors of all included articles were contacted for clarification or to request additional information. CO and KI independently appraised each included article using the Physiotherapy Evidence Database (PEDro) Scale, an eleven item scale widely used in physical therapy to assess the quality of RCTs [36, 37]. Items on the PEDro scale largely relate to design biases [36, 37]. Ten of the eleven items contribute to the summary score; a summary score of greater than five or six indicates adequate quality (Supplementary Table S2) [36, 37]. All articles were included irrespective of the outcome of the quality assessment to provide a comprehensive review of the literature. The analysis took the form of a narrative synthesis.

RESULTS

Article selection and quality appraisal

Of the 11,693 articles identified, 48 full text articles were screened and four met the eligibility criteria for inclusion. A further two articles were identified through reference screening.

A conference abstract was identified that described the development of a falls self-management guide for PwP to be delivered alongside physiotherapy [38]. The author was contacted; no details of the participants or how the intervention was implemented or evaluated were available, and it was excluded from our review.

No additional records were identified through searches of the grey literature and clinical trials registers. Thus six articles were included in the review (Fig. 1).

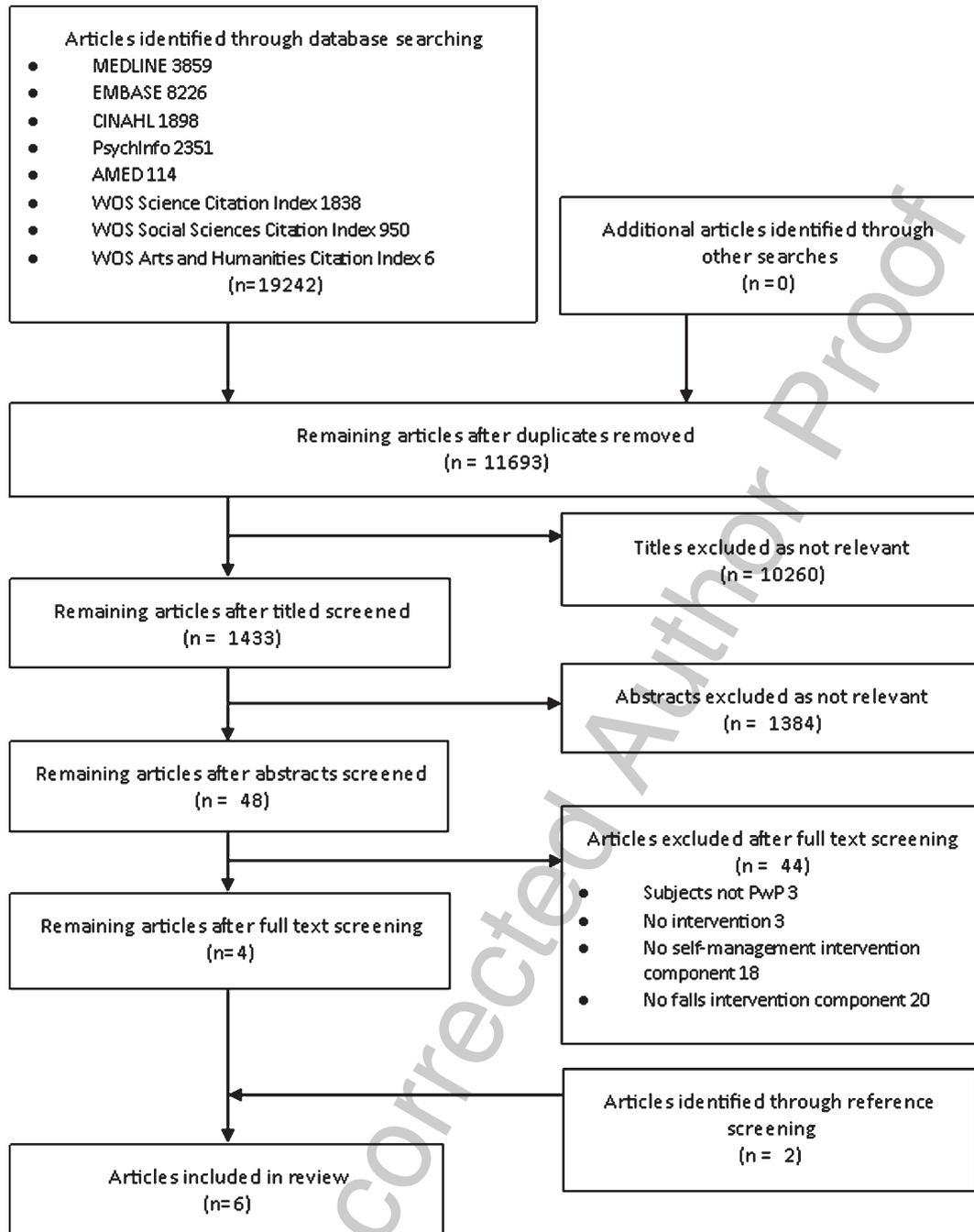


Fig. 1. Preferred Reporting Items for Systematic Reviews and meta-analyses (PRISMA) diagram detailing the search process undertaken in this review. n, number; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-analyses; PwP, People with Parkinson's.

240 Five of six articles had summary scores of
 241 greater than five out of ten on the PEDro scale,
 242 deeming them adequate quality [37, 39–43]. The
 243 article by Peteet scored four out of ten, deeming
 244 it low quality [44] (Table 3 and Supplementary
 245 Table 2).

Article characteristics

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Study design

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248 The included articles comprised five research
 249 papers and one thesis (Table 2). All reported RCTs.
 250 Two articles were based on the same population

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Table 1
Practical reviews in self-management support (PRISMS) self-management components of the interventions

PRISMS taxonomy component	Peteet [44]	Tickle Degnen et al. [42]	White et al. [43]	Canning et al. [41]	Morris et al. 2015 [39]	Morris et al. [40]
A1. Information about the condition and/or its management	✓			✓	✓	✓
A2. Information about available resources				✓	✓	✓
A3. Provision of/ agreement on specific clinical action plans and/or rescue medication						
A4. Regular clinical Review	✓					
A5. Monitoring of condition with feedback	✓					
A6. Practical support with adherence (medication or behavioral)						
A7. Provision of equipment						
A8. Provision of easy access to advice or support when needed						
A9. Training/ rehearsal to communicate with health care professionals				✓	✓	✓
A10. Training/ rehearsal for everyday activities		✓	✓	✓	✓	✓
A11. Training/ rehearsal for practical self-management. Includes skill acquisition				✓	✓	✓
A12. Training/ rehearsal for psychological strategies Includes action planning and goal setting	✓	✓	✓	✓	✓	✓
A13. Social support	✓	✓	✓			
A14. Lifestyle advice and support Includes advice about exercise and a healthy diet		✓	✓	✓	✓	✓

and intervention; the participants in White et al. were a subsample of those from Tickle-Degnen et al. but different outcome measures were reported [42, 43].

No articles were identified that studied the effect of a falls self-management intervention in isolation. Each article evaluated the effect of a self-management intervention alongside a physiotherapy intervention. Canning et al. studied the effect of an intervention that contained physiotherapy and self-management, and compared it to self-management alone [41]. The other five articles studied the effect of an intervention that contained physiotherapy and self-management and compared it to a control which did not contain either of these constituents [39–43].

Setting and participant characteristics

Trials were conducted between 2003 and 2016; three in Australia and three in the USA. The total number of participants was 718 (range 27 to 231 in each study). Participants were all PwP, no interventions included caregivers. Mean age varied from 58 to 71.4 years; mean time from diagnosis was 5.1 to

8.8 years. In five of six articles, the majority of participants had a Hoehn and Yahr stage of less than three, indicating reduced fall risk [39, 40, 42–44]. All articles excluded those with cognitive impairment. In the three data sets that reported baseline falls, 55 to 78% had fallen within the last year [39–41].

Intervention delivery

Self-management interventions were delivered through either group discussion or the provision of falls booklets. In each of the group interventions, falls self-management was embedded within a programme that targeted self-management of a range of PD related difficulties [42–44]. In the three articles containing falls booklets, falls was the key target of the intervention [39–41].

1. Group discussion

Three articles, evaluating two different interventions described physical therapist facilitated group discussion of self-management alongside physiotherapy [42–44]. Peteet assessed the effect of a weekly physical exercise and self-management education programme compared to exercise alone [44]. The

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Table 2
 Characteristics of articles included in the review

Article authors and year	Participants						Intervention including Self-Management		Comparison Intervention	
	Study design	Number	Mean age (SD)	H+Y (%)	Mean years since diagnosis (SD)	Mean MMSE (SD)	Fallen in the last year	Description	1. Frequency and duration 2. Setting 3. Delivered by	Description
Peteet [44]	27	Intervention 58 (7.0)	H+Y II 74%	Intervention 8.8 (3.9)	All ≥25	No data	1. Behavioural based self-management education programme. Week 4 contained a 20–25 min group discussion about fall prevention and safety.	1. 1.5 h/ week for 6 weeks	Exercise programme only	1. 1.5 h/ week for 6 weeks
RCT		Control 63 (9.5)	H+Y III 26%	Comparison 7.0 (4.4)			2. Exercise programme	2. Hospital 3. Therapist with physical therapy assistance		2. Hospital 3. Therapist with physical therapy assistance
Tickle-Degnen et al. [42]	117	66.3 (9.0)	H+Y <III 84%	7.1 (5.7)	29.3 (1.0)	No data	Intervention 1 and 2 Twice weekly 'Group clinic sessions'	Group sessions:	'Social group sessions' including ice breaker activities, refreshments and conversation	1. 1.5 h/week for 6 weeks
3 arm RCT			H+Y III 16%				1. Motion, flexibility and strength exercises (25 minutes) 2. Speech exercises (10 min)	1. 2 × 1.5 h/week for 6 weeks 2. Hospital		2. Hospital 3. Physical therapy student

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								3. Daily function training examples (15 min)	3. Physical therapist
								4. Gait training (10 min)	Transfer sessions
								5. Group discussion (30 min), including 'preventing falls'	1. 1.5 h/week for 6 weeks
								Intervention 2 only	2. Home
								Additional weekly transfer sessions	3. Physical therapist
White et al. [42]	74 AM data	Intervention 65.6 -68.2	H+Y <III 85%	Intervention 5.1- 6.9	No data	No data		[as per Tickle-Degnen et al. [42]]	
3 arm RCT	108 2MWT data	Control 65.4- 66.0	H+Y III 15%	Comparison 5.6- 6.7					
Canning et al. [41]	231	Intervention 71.4 (8.1) Comparison 69.9 (0.3)	Intervention H+Y II 30%	Intervention 7.5 (5.8)	Intervention 28.6 (1.5)	78%	Physiotherapy Progressive balance and lower limb strengthening exercises and cueing strategies (PD-WEBB), exercise classes and physical therapist home visits PLUS Education: Received the booklet 'Don't fall for it, falls can be prevented'.	Over 6 months:	Received the booklet 'Don't fall for it, falls can be prevented'.

(continued)

Morris et al. [40]	133	71 (9)	H+Y <III 66%	Unknown	28.3 (1.6)	55%	Physiotherapy Progressive resistance strength training Movement strategy training PLUS Education Individualized falls education based on the booklet 'Don't fall for it, Falls can be prevented'. Participants given a copy to take away.	1. Physiotherapy: 2 h/week for 6 weeks. Falls education delivered weekly. 2. Home 3. Physical therapist led	Life skills program. Weekly guided education and discussion sessions followed by self-directed homework. No falls content. A standard help sheet from Parkinson's Victoria and a generic falls information sheet.
			H+Y III 29%						
RCT			H+Y IV 5%						

h, hours; H+Y, Hoehn and Yahr staging; min, minutes; MMSE, Mini-Mental State Examination score; RCT, randomized controlled trial; SD, standard deviation.

Table 3
Outcomes of articles included in the review^a

Article	Statistical comparisons made		Quality Assessment ^b	Falls Outcomes	FES-I	QOL	Mood	Other Outcomes measured		
	Summary of Intervention containing self-management	Summary of comparator						Outcome	Results	
Peteet [44]	Self-management plus exercise programme	Exercise Programme	4/10					Physical Activity Scale for the elderly (PASE), TUG, FRT	No change at 6 weeks or at 12 weeks	
Tickle-Degnen et al. [42]	Self-management plus physiotherapy	Social Group sessions (No self-management or physiotherapy)	7/10			PDQ-39	Improvement post intervention and at 6 month follow-up ($p = 0.02$)			
White et al. [43]	Self-management plus physiotherapy	Social Group sessions (No self-management or physiotherapy)	5/10					Total time spent walking and number of walking periods	No change	
Canning et al. [41]	Self-management plus physiotherapy	Self-management	7/10	No difference in rate of falls or in the number of fallers over 12 months.	Improvement post intervention ($p < 0.01$)	SF6D	Improvement post intervention ($p < 0.01$)	Significant improvement in positive affect score post intervention ($p < 0.05$)	Short physical performance battery and sit to stand.	Improvement post intervention ($p < 0.05$)
						SF-12 physical, SF-12 mental, PDQ39	No change		Mean knee extensor strength, co-ordinated stability test, 4 m fast walk test, FOG, Exercise h/week, ADL h/day	No change

Morris et al. 2015 [39]	Self-management plus physiotherapy (MST or PRST)	Life Skills Programme (No self-management or physiotherapy)	7/10	Reduced rate of falls over 12 months associated with MST ($p < 0.05$) and PRST ($p < 0.01$) No difference in number of fallers or multiple fallers over 12 months.	PDQ39	PRST: Improvement at 12 months ($p < 0.05$)	UPDRS ADL	MST and PRST: Improvement at 12 months ($p < 0.01$).
						MST: no change	UPDRS Motor	MST: Improvement at 12 months ($p < 0.05$)
					EQ-5D VAS	MST and PRST: no change	Walking speed (derived from 6 m walk test) and TUG	No change
Morris et al. [40]	Self-management plus physiotherapy	Life Skills Programme (No self-management or physiotherapy)	6/10	No difference in the rate of falls or number of fallers or multiple fallers over 12 months.	PDQ39	No change	UPDRS	No change
					EuroQol-5D	No change		

ADL, Activities of Daily Living; EQ-5D VAS, EuroQol 5 Dimensions Visual Analog Scale; FES-I, Falls Efficacy Scale International; FOG, Freezing of gait; FRT, Functional Reach Test; MST, Movement Strategy Training; PASE, Physical Activity Scale for the elderly; PDQ39, Parkinson's Disease Questionnaire 39; PRST, Progressive resistance strength training; SF-6D, Short form 6 dimension; SF-12 physical/ SF-12 mental, Short form 12 physical/ short form mental component summary; TUG, Timed up and Go; UPDRS, Unified Parkinson's Disease Rating Scale. ^aPrimary outcomes in bold (Peteeet did not define which outcome was the primary outcome). ^bQuality assessment performed using the PEDro scale. Summary scores are out of ten possible quality criteria. Scores of greater than five indicate adequate quality [37].

intervention was delivered over six weeks by a physical therapist and contained weekly individualized education sessions. Only week four of the intervention focused on falls, where a 20–25 minute therapist led discussion on falls was delivered, which included falls prevention, safety and strategies to minimize falls. Participants were encouraged to develop and complete exercise-related action plans. Tickle-Degnen et al. and White et al. assessed the effect of a weekly group-based self-management rehabilitation programme delivered over six weeks by a physical therapist, compared to social group sessions that contained no self-management or falls-based content [42, 43]. Each session consisted of one hour of physiotherapy and speech therapy followed by a 30 minute group discussion, which included the topics ‘preventing falls’, ‘strategies to improve walking’, ‘relaxation, stress management’ and ‘benefits of exercise’.

2. Falls booklets

Three articles, Canning et al., Morris et al. 2015 and Morris et al. 2017, contained a self-management component based upon the same the falls booklet ‘Don’t fall for it. Falls can be prevented!’, which was delivered alongside physiotherapy [39–41, 45]. This 32 page booklet is aimed toward all older people at risk of falling and contains no PD-specific information [39–41, 45]. In Canning et al., participants in both arms of the study were given a copy of the booklet and no verbal falls education was delivered; only the physiotherapy component differed between the intervention and control arms [41]. In Morris et al. 2015 over eight weeks, and Morris et al. 2017 over six weeks, weekly falls education was delivered by a physical therapist based upon the content of the booklet and participants were given a copy to take away [39, 40]. In Morris et al. 2015 education was delivered over eight weeks; it was unclear whether it was individualized. In Morris et al. 2017 education was delivered over six weeks and was individualised to participants. The comparator groups in both Morris et al. 2015 and Morris et al. 2017 took part in weekly non-falls education sessions; in Morris et al. 2017 participants also received a non-self-management-based falls information sheet to take away [40].

Analysis of self-management components of the interventions

Table 1 summarises the self-management intervention components reported in each study based on the PRISMS taxonomy. Description of the self-

management component was very brief; articles described them in an average of 60 words [39–43]. Additional information was received from three authors [39, 40, 44]. Through the citations provided, we were able to obtain and directly review the falls booklet utilized within three of the articles [39–41, 45].

Information about the condition and/or its management

A fundamental part of self-management is arming patients with appropriate information about the condition and/or its management. This component was present in four of six articles. However, the topics, amount and presentation of information differed. Peteet provided participants in both trial arms with written information about PD, with those in the intervention arm also receiving information about falls [44]. In Tickle-Degnen et al and White et al, it is unclear whether participants received any information specific to PD or to falling [42, 43]. The booklet utilized within three articles covers a wide breadth of falls-related topics, including potential aetiologies and different management strategies [45].

Training/rehearsal for everyday activities

Another key component of a self-management intervention is learning and practicing behaviors and skills that are relevant for living with the condition. All articles delivered this component through physiotherapy strategies such as training with transfers, cueing strategies and movement strategy training, which includes training for functional tasks [39–44]. Five articles delivered this component through self-management strategies. Although the group discussions delivered by Tickle-Degnen et al and White et al, contained information about day to day activities such as strategies to improve dressing and walking, it is unclear whether these were falls-related [42, 43]. The booklet used within three articles encourages users to ask for help from others if they consider a task to be high risk and to plan ahead [45].

Training/rehearsal for psychological strategies

Self-management interventions often facilitate the development of psychological strategies such as the ability to re-frame symptoms, problem-solve and set personal goals. This component was present in all articles reviewed. The interventions that contained group discussion (Peteet et al., Tickle-Degnen et al.

and White et al.) taught and encouraged participants to problem-solve and to develop realistic action plans in collaboration with a physical therapist [42–44]. However, it is unclear whether these action plans were falls-related, with no details provided surrounding their implementation. The booklet used within three articles has a page to develop action plan, but the interventions based upon this booklet did not appear to provide participants with training to complete these [39–41, 45].

Lifestyle advice and support

Self-management interventions often contain advice about health and lifestyle; this was included within five of six of the articles. In the group sessions within Tickle-Degnen et al. and White et al., participants discussed the ‘Benefits of exercise’ [42, 43]. The booklet utilized within three articles promotes a healthy lifestyle, including the importance of physical activity and dietary advice [39–41, 45].

Social support

All three articles that provided group discussion led by physical therapist provided social support [42–44]. Peteet actively encouraged group interaction; participants were asked to identify a ‘buddy’ for support although this appeared to be for exercise promotion and not for falls management [44]. No social support component was provided in the three articles that utilized the falls booklet [39–41].

Other components

Self-management interventions may contain regular clinical review and monitoring of the participant’s condition with feedback. Whilst provided within Peteet, these components were targeted toward exercise and not falling [44]. In addition to the components described above, the booklet utilized within three articles supports falls self-management through providing (i) information about available resources, (ii) training to communicate with healthcare professionals to facilitate shared decision-making, and (iii) training/ rehearsal for practical self-management through teaching common strategies to reduce fall risk in the home [39–41, 45].

Further components that the PRISMS taxonomy suggests may be contained within a self-management intervention, but were not included within any of the articles, were (i) individualized action plans prepared by a healthcare professional, (ii) practical support with adherence, (iii) provision of equip-

ment, and (iv) easy access to further advice and support.

Outcome measures

All articles assessed the effect of the intervention as a whole (Table 3). No articles separated the effect of the self-management component from the physiotherapy component, or assessed skill acquisition or adherence to the self-management component.

Falls outcomes

The three articles where the self-management component was based upon the falls booklet reported falls [39–41]. In Morris et al. 2015 participants fell less over 12 months when they received physiotherapy and self-management versus no physiotherapy or self-management [39]. However, no improvement was seen in the total number of participants who fell in Canning et al., Morris et al. 2015 or Morris et al. 2017 [39–41]. Morris et al. 2015 and Morris et al. 2017 found no difference in the number of multiple fallers, with combined physiotherapy and self-management versus no physiotherapy or self-management [39, 40]. Sub analysis in Canning et al. found a 69% reduction in falls in those with less advanced PD who received physiotherapy and self-management versus self-management alone [41]. Articles based on group discussion did not report falls outcomes.

Only Canning et al. assessed fear of falling, which was measured through the Falls Efficacy Scale- International scale, which assesses concerns about falling in 16 different circumstances [41, 46]. Scores significantly improved at six months in participants who received physiotherapy and self-management versus self-management alone [41].

Quality of life (QOL)

Four articles assessed QOL. Tickle-Degnen et al. reported that combined physiotherapy and self-management was associated with significant improvement in health-related QOL (HRQOL) measured by Parkinson’s Disease Questionnaire 39 (PDQ39) at programme end at six weeks when compared to the control arm; improvement persisted at six months [42]. The three studies whose self-management component was based upon the falls booklet produced inconsistent results regarding QOL. In Morris et al. 2015, when compared to no physiotherapy or self-management, one intervention arm (progressive resistance and strength training plus self-management) was associated with

491 an improvement in QOL as measured by PDQ39
 492 but no change was observed in EuroQol 5 Dimen-
 493 sions Visual Analogue scale (EQ-5D VAS); in the
 494 other intervention arm (Movement strategy training
 495 plus self-management) no improvements were seen
 496 in either PDQ39 or EQ-5D VAS [39]. The combined
 497 physiotherapy and self-management intervention in
 498 Morris et al. 2017, was not associated with improve-
 499 ments in QOL when compared to no physiotherapy or
 500 self-management [40]. Canning reported significant
 501 improvement in Short-Form Six-Dimension (SF-6D)
 502 in participants who received physiotherapy and self-
 503 management compared to self-management alone;
 504 however, no change was observed in relation to either
 505 PDQ39 or the mental and physical sub scores of
 506 Short-Form 12 (SF-12) [41].

507 *Other outcome measures*

508 Four articles reported various physical activity out-
 509 comes [39, 41, 42, 44]. Peteet, Morris et al. 2015 and
 510 White et al. found no statistical difference in phys-
 511 ical activity outcome measures in participants who
 512 received each of the respective physiotherapy and
 513 self-management interventions compared to no phys-
 514 iotherapy and self-management [39, 43, 44]. Canning
 515 et al. reported improvement in the short physical per-
 516 formance battery and sit to stand in participants who
 517 received physiotherapy and self-management com-
 518 pared to self-management alone, but no improvement
 519 was seen in a number of other measures including
 520 exercise hours/week [41].

521 Two articles collected Unified Parkinson's dis-
 522 ease rating scale (UPDRS) data. Morris et al. 2015
 523 reported significant improvement in the activities of
 524 Daily Living (ADL) component of UPDRS, but not
 525 the motor component of the UPDRS in participants
 526 who received physiotherapy and self-management
 527 versus no physiotherapy or self-management [39].
 528 Morris et al. 2017 reported no change in UPDRS
 529 with physiotherapy and self-management versus no
 530 physiotherapy and self-management [40].

531 Canning et al. reported adverse outcomes related
 532 to the physiotherapy component of the intervention;
 533 two participants fell whilst exercising at home [41].
 534 No studies reported adverse outcomes relating to the
 535 self-management component.

536 **DISCUSSION**

537 This is the first attempt to systematically review
 538 the literature on falls self-management interventions

539 for PwP. Other reviews have begun to explore more
 540 generic self-management interventions to support
 541 PwP [29]. Despite a thorough and systematic search,
 542 few relevant studies were identified, allowing us to
 543 conclude that this is not a well-researched area. All
 544 of the articles included studied the effect of a self-
 545 management intervention, comprised of either group
 546 discussion or a falls booklet, alongside a physiother-
 547 apy intervention. Self-management was often not the
 548 main focus of the intervention and was incompletely
 549 described. Articles displayed considerable variation
 550 in outcomes measured.

551 *Methodological comments*

552 All articles with the exception of Peteet were of
 553 adequate quality [44]. However, participants enrolled
 554 into studies were not representative of the range of
 555 PwP who fall, typically recruiting those with lower
 556 Hoehn and Yahr scores for example, and two arti-
 557 cles studied the effect of the same intervention on
 558 the same cohort of participants. All articles excluded
 559 those with cognitive impairment, yet this group are
 560 at heightened risk of falling and its negative physical
 561 and psychological outcomes [4]. No articles included
 562 caregivers, who play a pivotal role in falls manage-
 563 ment [4, 8]. Including caregivers in future research
 564 programmes may facilitate the inclusion of PwP
 565 with cognitive impairment, and improve caregiver
 566 outcomes.

567 Whilst the articles included a wide breadth
 568 of self-management strategies, these were often
 569 incompletely described, as has been identified in
 570 previous reviews of self-management interventions
 571 [34]. It is unclear whether the interventions delivered
 572 self-management as planned. Whilst multifaceted
 573 interventions may be more likely to benefit older peo-
 574 ple who fall, all intervention components should be
 575 well described to allow for them to be identified and
 576 replicated [32, 47–49].

577 Key attributes that an individual requires to
 578 effectively self-manage a LTC are problem-solving,
 579 decision-making and goal setting [22]. None of the
 580 articles included within this review studied the effect
 581 of an intervention that clearly taught and promoted
 582 all three of these skills. Individuals also require infor-
 583 mation specific to their needs; however, in only one
 584 article was the intervention individualized to partici-
 585 pants [22, 40]. Providing a heterogeneous population
 586 with generic information can lead to information
 587 overload and user disengagement [39–41, 45, 50].
 588 Future falls self-management programmes for PwP

589 should explore tailoring of information to partici-
590 pants' needs to increase the likelihood of adherence
591 and long-term behavioral change [23, 51].

592 *Impact of self-management programmes on falls* 593 *and other clinical outcomes*

594 All articles assessed the effect of physiother-
595 apy and self-management in combination, making it
596 impossible to draw firm conclusions about the spe-
597 cific contribution of falls self-management from the
598 studies conducted so far.

599 In the three articles where falls outcomes were
600 measured, only one recorded a reduced rate of falls,
601 and none showed a reduction in the number of
602 fallers [39, 41, 52]. Given that current evidence
603 for rehabilitation interventions to reduce falls is
604 inconclusive, the effect of self-management on falls
605 remains unclear. Only Canning et al. 2015 measured
606 fear of falling, however, as only the physiotherapy
607 component differed between the intervention and
608 comparator groups, the effect of self-management on
609 fear of falling remains unexplored [41].

610 Most articles measured QOL but only the interven-
611 tion studied by Tickle-Degnen et al., which contained
612 group discussion and education to problem-solve
613 and develop action plans, led to an improvement
614 [42]. Group-based self-management programmes
615 have previously been shown to provide social sup-
616 port and psychological benefit [53]. However, future
617 researchers should consider their acceptability to par-
618 ticipants with reduced mobility, where travel may be
619 difficult, and explore the impact of programme end,
620 which can lead to feelings of isolation [53].

621 No articles measured self-management outcomes
622 such as applicable knowledge or independence,
623 which are considered important by those with LTCs
624 [54]. It is impossible to tell whether and to what extent
625 PwP engaged with the self-management components.
626 Future self-management programmes should look to
627 include process evaluation measures such as accept-
628 ability, adherence and engagement; mixed methods
629 are likely to be useful [55].

630 *Conclusion*

631 Overall, the scarcity of published research, plus the
632 nature of the studies to date, have made it impossi-
633 ble to draw any firm conclusions about the overall
634 efficacy of falls self-management interventions for
635 PwP, or to identify the important components of these
636 interventions.

637 Within the articles included in this review, it is
638 unclear whether interventions were targeted toward
639 PwP who had experienced falls, and information was
640 rarely individualized to participants. Future studies of
641 programmes of falls self-management interventions
642 may benefit from targeting those whom falls manage-
643 ment is most critical, to include PwP with a history
644 of falls, fear of falling and/or cognitive impairment,
645 and caregivers.

646 Given the limitations of other interventions to
647 support falling in PwP, and the benefits seen in self-
648 management programmes in other LTCs, it is impor-
649 tant that effective falls self-management programmes
650 are developed and evaluated to support PwP.

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667 **CONFLICT OF INTEREST**

668 The Authors have no conflict of interest to report.

669 **SUPPLEMENTARY MATERIAL**

670 The supplementary material is available in the
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672

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