**Treatment burden for patients with multimorbidity: cross-sectional study with exploration of a single-item measure**

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**Abstract**

***Background***

Treatment burden is the effort required of patients to look after their health, and the impact this has on their wellbeing. Quantitative data on treatment burden for patients with multimorbidity are sparse, and no single-item treatment burden measure exists.

***Aim***

To determine the extent of, and associations with, high treatment burden among older adults with multimorbidity, and explore the performance of a novel single-item treatment burden measure.

***Design and Setting***

Cross-sectional postal survey via general practices in Dorset.

***Method***

Patients ≥55y, living at home, with ≥3 long-term conditions (LTCs) were identified by practices. Treatment burden was measured using the Multimorbidity Treatment Burden Questionnaire. Data collected included: sociodemographics; LTCs; medications; characteristics including health literacy and financial resource. Associations with high burden were investigated via logistic regression. Performance of a single-item measure was evaluated.

***Results***

835 responses were received (response rate 42%) across 8 practices: mean age 75y; 55% female; 99% White. Notably 39% did not self-report ≥3 LTCs. 18% reported high treatment burden; making lifestyle changes and arranging appointments were notable sources of difficulty. After adjustment, limited health literacy, and financial difficulty, displayed strong associations with high treatment burden; more LTCs and more prescribed regular medications were also independently associated. The single-item measure discriminated moderately between high/non-high burden; sensitivity 89%, but specificity 58%.

***Conclusion***

High treatment burden was relatively common, underlining the importance of minimising avoidable burden. Further development of a single-item measure is required. More vulnerable patients, with less capacity to manage, are at greater risk of being overburdened.

**Keywords**

Multimorbidity

Cross-sectional studies

General practice

Patient-centered care

Patient reported outcome measures

Self-management

**How this fits in**

Patients with multimorbidity may experience treatment burden from healthcare demands, but the extent of, and factors associated with, high treatment burden are not well understood. In this survey of older adults with multimorbidity, almost one-fifth reported ‘high’ treatment burden – associated not only with greater number of long-term conditions and more prescribed regular medications, but also with characteristics indicating reduced ‘capacity’ to manage, namely limited health literacy and financial difficulty. GPs have a central role in incorporating these considerations into patient care, to try to ensure patients are not overburdened. Additionally, existing measures of treatment burden are too time-consuming for clinical use; a novel single-item measure was explored here, but performed moderately: further development of such a measure is required.

**Introduction**

Treatment burden is the effort required of patients to look after their health and the impact this has on their functioning and wellbeing.1-3 Recognition of treatment burden in people living with long-term conditions (LTCs) is increasingly important, given the ageing populations of many countries and increasing prevalence of LTCs and multimorbidity.4 5 Workload of healthcare can include ordering and taking medications, organising and attending healthcare appointments, monitoring health conditions, and modifying lifestyle behaviours.6 For people living with multimorbidity, clinicians may be following multiple single-disease guidelines, an important driver of polypharmacy and potentially of treatment burden.7 8 In the United Kingdom (UK), National Institute for Health and Care Excellence (NICE) 2016 guidance for the assessment and management of multimorbidity advises taking an approach to care that includes ‘improving quality of life by reducing treatment burden’.9

Negative impacts of treatment burden are various and include those of both a psychological and practical nature, such as interference with daily activities, negative emotions, and strained relationships.10 11 Patients may seek to minimise disruptions through adaptation, but also by non-adherence to treatment.10 12 When thinking about treatment burden, it is important to consider patient ‘capacity’: the abilities, resources and readiness to address the combined demands of treatment workload and daily life.13 Components of capacity may include socioeconomic resources such as financial wellbeing and support networks, health literacy, relevant knowledge and experience, and physical and mental functioning.13 14 When workload exceeds available capacity, patients may be described not only as experiencing high treatment burden, but as being overburdened – with potential risk of involuntary non-adherence, disruption to care, and adverse health outcomes.13 15 A degree of treatment burden is perhaps inevitable in managing LTCs, but seeking to minimise unnecessary burden is important, as encapsulated by ‘minimally disruptive medicine’.16

Validated instruments now exist to measure patient-perceived treatment burden.17-21 However, quantitative data on the extent of, and factors associated with, high treatment burden for patients with multimorbidity are limited. Measuring treatment burden is not currently part of routine care and existing measures are too long for time-constrained clinical encounters, particularly in UK general practice (GP). The aims of this study were to: (i) determine the extent of treatment burden, and explore characteristics associated with high treatment burden, among adults ≥55y with ≥3 specified LTCs documented in their GP records; (ii) explore the performance of a novel single-item treatment burden measure in the same sample.

**Methods**

***Survey design and sample***

A cross-sectional postal survey of older adults with multimorbidity was conducted in Dorset, England, between February–July 2019. Patients aged ≥55y, living at home, and with ≥3 LTCs from a specified list, were identified for invitation from GP registers. Inclusion and exclusion criteria are shown in Box 1. Quality and Outcome Framework (QOF) clinical code clusters22 defined 14 LTCs, with Read codes23 (structured clinical terms) defining a further five. The 19 LTCs selected were common, readily identified from GP records, and represented a range of body systems. Conditions considered distinct regarding likely avoidability or perception of treatment burden (*e.g.* cancer, severe mental health diagnoses) were not included. The cut-off of ≥55y defining ‘older’ adults was lower than a more orthodox ≥65y threshold: more deprived groups may experience multimorbidity at younger ages.24 Treatment burden was measured using the 10-item Multimorbidity Treatment Burden Questionnaire (MTBQ):21 a concise, simply-worded instrument suitable for self-completion, with good coverage of burden domains and validated in a multimorbid population similar to that in the current study. These characteristics conferred greatest suitability relative to other candidate measures,17-20 which variously exhibited limitations such as wording complexity, narrowness of focus, or considerable length. Each MTBQ item is scored as follows: zero (not difficult/ does not apply), one (a little difficult), two (quite difficult), three (very difficult), four (extremely difficult); for those completing ≥5 items, average item score is multiplied by 25 to yield a global score of 0-100. Treatment burden is categorised as none (global score 0), low (>0 and <10), medium (≥10 and <22) or high (≥22).

Self-reported data on a range of variables were collected through the survey, in areas including: sociodemographics, prescribed regular medications, specific LTCs (corresponding to survey inclusion criteria), travel for healthcare, recent healthcare resource use, and health status/ quality of life. Home ownership (dichotomised as home owner/ non-home owner) served to measure socioeconomic status (SES). Characteristics indicative of capacity were captured, including financial resource via perceived level of difficulty in meeting financial costs of healthcare (on a 5-point Likert scale from ‘no’ to ‘extreme’ difficulty), and health literacy via the Single Item Literacy Screener (SILS) – which asks about perceived frequency of needing help to read health-related written material (on a 5-point Likert scale, with descriptors ‘sometimes’, ‘often’ and ‘always’ indicating limited health literacy).25

A single-item measure of treatment burden was also explored: “*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?*”, with respondents circling along a number-line. This measure was novel and did not undergo formal development; however, wording and format embodied principles within existing measures of self-rated health (the EQ visual analogue scale26) and pain (the numerical rating scale for pain27). Additionally, MTBQ unidimensionality lent legitimacy to trialling a single-item measure.

Based on a 26.6% prevalence for high treatment burden from MTBQ validation data,21 identifying those with high burden required ≥300 survey responses for a maximum 95% confidence interval (CI) width of +/- 5%, considered sufficiently precise. nQuery 7.0 was used for the sample size calculation.28

Survey documents were refined using a ‘think-aloud’ procedure (a cognitive-interviewing approach for pre-testing self-completion questionnaires),29 conducted with colleagues and a lay representative. Survey questions and response options appear in Supplementary Box 1. This paper reports on a subset of data and analyses.

***Recruitment, invitation, and response***

Recruitment of GP practices sought eight geographically dispersed, socioeconomically diverse sites across Dorset. Each participating practice identified survey invitees by electronically searching their patient list with a supplied algorithm, and manually screening a random sample of resulting records – identifying at most 250 invitees meeting the inclusion/exclusion criteria. Reasons for manual exclusions were requested.

Practices posted survey packs comprising a personalised invitation letter, information sheet, consent form, survey booklet, and return envelopes. Freepost returns, GP practice endorsement, uncomplicated means of participation, and a survey designed to minimise completion burden all sought to maximise response rate, as did an online response platform offered via weblink. Participants provided written (or online equivalent) consent; and could optionally consent to GP-record data-sharing with the study team, and to receive a potential follow-up survey (both outwith the scope of this paper).

***Statistical analyses***

Survey data underwent manual database input, with a 5% double-entered sample facilitating error-rate estimation. Analysis took place in SPSS Statistics v24.30 Descriptive statistics were used to explore characteristics of the respondent sample, non-response bias based on age and sex, and distribution of treatment burden. A binary outcome of high treatment burden *vs* no/low/medium burden combined, was used (this dichotomy lending a focus to the most impacted group). Other variables acted as exposures. Univariable and multivariable logistic regression were used to identify associations with high treatment burden. Variables were considered for inclusion in a final multivariable model if deemed clinically important *a priori* or shown to be statistically significant (at p<0.05) at the univariable stage. Variables for healthcare resource use (number of GP and outpatient appointments in the previous 6 months) were excluded given risk of poor recall and greater amounts of missing data; travel time to hospital was also excluded since it was not relevant for all respondents. The final, parsimonious model was mutually adjusted for: age, sex, marital status, home ownership, number of LTCs, number of prescribed regular medications, health literacy, and financial difficulty.

For the single-item measure, the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV), at each integer number-line cut-off were calculated. ‘Correct’ identification of high treatment burden was determined relative to the MTBQ as a reference standard. A receiver operating characteristic (ROC) curve was plotted, and area under the curve (AUC) computed to evaluate the ability of the single-item to discriminate between high and non-high treatment burden.

**Results**

Eight practices were recruited, exhibiting heterogeneity in geographic location (including rurality/urbanity), deprivation level, and list size (Supplementary Table 1, which also presents practice demographics relative to national data). Manual exclusion of potentially eligible patients most commonly occurred at practice discretion (data from 7 sites). In total, practices posted out 1,983 surveys; 835 usable responses were received (response rate 42%), the vast majority by post (n=808, 96.8%). Please see the flowchart (Figure 1).

With the exception of the questions about healthcare resource use, there was minimal missing data. A data-entry error-rate of <0.1% was estimated, deemed acceptably low. Age and sex distributions of the respondent sample closely matched those of the invited sample (Supplementary Table 2). Respondent characteristics are shown in Table 1. Mean age of respondents was 75y, with 54.6% (n=453) female and 99.2% (n=822) of White ethnicity. Respondents were generally retired (n=716, 86.6%); many were married/ in a civil partnership (n=520, 63.0%). Most owned their own home (n=654, 79.3%).

A substantial minority (n=325, 39.4%) did not self-report ≥3 survey-specified LTCs, despite presence of three or more such conditions in the GP record being an inclusion criterion. The most frequently self-reported LTCs were hypertension (n=531, 64.4%), osteoarthritis (n=331, 40.2%), and type 2 diabetes (n=248, 30.1%) (Supplementary Table 3). Polypharmacy was common, with 46.1% of respondents (n=381) prescribed ≥7 medications (Table 1).

Some financial difficulty with healthcare (level of difficulty described as ‘a little’, ‘quite’, ‘very’, or ‘extreme’) was reported by 26.4% of respondents (n=219), and limited health literacy by 16.7% (n=139). The number of GP appointments was recalled as being ≥3 over the previous 6 months by 35.6% of respondents (n=258), and the number of hospital outpatient appointments ≥3 over the same time period by 20.5% (n=156). For both these types of healthcare resource, respondents being unable to remember/provide the number of appointments attended (despite indicating at least one attendance) was the principal reason for missing data.

Distribution of global score for the 833 MTBQ respondents is shown in Figure 2. ‘High’ treatment burden was reported by 18.0% (n=150), ‘medium’ by 26.9% (n=224), and ‘low’ by 32.2% (n=268); no burden was reported by 22.9% (n=191) (Table 1). Treatment burden domains in which respondents most commonly reported ‘some difficulty’ (MTBQ item score >0) were: ‘making recommended lifestyle changes (*e.g.* diet/exercise)’ with 47.0% (n=390) reporting difficulty; and ‘arranging appointments with health professionals’ (39.4%, n=327) (Supplementary Table 4).

***Associations with high treatment burden***

On univariable analysis, high treatment burden was associated with: younger age; female sex; non-home ownership; greater number of LTCs; more prescribed regular medications; limited health literacy; financial difficulty with healthcare; longer travel time to hospital; and more outpatient appointments, and GP appointments, in the previous six months.

The final multivariable model was mutually adjusted for age, sex, marital status, home ownership, number of LTCs, number of prescribed regular medications, health literacy and financial difficulty. Strong independent associations (at p<0.001) were observed for both limited health literacy (odds ratio (OR) 3.64, 95% CI 2.24 to 5.92) and financial difficulty (OR 3.94, 95% CI 2.56 to 6.07), both being dichotomised variables. Independent associations were also seen for greater number of LTCs (overall p=0.008 with ORs reaching significance at ≥5 LTCs, *e.g.* OR 2.98 with 95% CI 1.13 to 7.84 for 5 LTCs *vs* ≤1), and more prescribed regular medications (p=0.04, OR 1.62, 95% CI 1.03 to 2.55, for ≥7 medications *vs* <7) (Table 2).

***Single-item measure***

Setting a threshold of ≥5 for high treatment burden on the single-item measure (optimising its performance) yielded a sensitivity of 89%, specificity 58%, PPV 31%, and NPV 96%. Supplementary Table 5 presents the underlying data for the n=826 respondents. Figure 3 displays the ROC curve; AUC was 0.77 (95% CI 0.73 to 0.81).

**Discussion**

***Summary***

This cross-sectional study of older adults with multimorbidity identified that high self-reported treatment burden was reported by almost a fifth of participants. Making recommended lifestyle changes, and arranging appointments with health professionals, frequently contributed to burden. High treatment burden was strongly associated with limited health literacy and reported financial difficulty with healthcare; greater number of LTCs and more prescribed regular medications were also independently associated. These findings imply that more vulnerable patients, with less capacity to manage, are at particular risk of being overburdened by healthcare demands. A novel single-item measure of treatment burden was explored, but performed moderately: further development of such a measure is required.

***Strengths and limitations***

Study strengths include: the number of respondents considerably exceeding the minimum target sample size, generally little missing data, and virtually no non-response bias in age or sex. Regarding SES, the proportion of home-owners, at 79%, is comparable to the 77% observed in those aged ≥55y nationally (English Housing Survey 2018-19 data)31, and the predominantly postal response supports generalisability beyond just the computer-literate. The survey captured numerous characteristics including those indicative of patient capacity. Investigation of a single-item measure was novel, to the authors’ knowledge.

However, there are important limitations. Given the cross-sectional design, findings represent association, not causation. As often seen with postal surveys, absolute response rate was low (42%): while low response rate is not synonymous with non-response bias,32 characteristics of non-responders could not be assessed beyond age and sex. The proportion with high treatment burden may be an underestimate if those experiencing the highest levels of burden were – as a consequence – less likely to respond. If non-responders also had lower levels of health literacy (which is plausible), the positive association identified between limited health literacy and high treatment burden might be underestimated. SES was captured only via the proxy measure of home ownership: a limitation, although home ownership has been shown to have some value as a marker of SES, particularly among older people in Britain.33 Unaccounted confounding may also be occurring, for example through the potential influence of carer burden or functional incapacity among respondents; importantly, individual LTC severity was also not measured. The SILS captured patient-perceived reading ability: a central component of, but not wholly characterising, the multifaceted concept of health literacy.34 Despite respondent home ownership levels comparable to England, caution is required before generalising findings from this Dorset study to other areas, given the below-national-average deprivation profile of participating practices and predominatly White ethnicity of the sample.

Almost 40% self-reported <3 LTCs, at variance with their GP record. This could reflect limited recall, or lack of awareness if diagnoses were not discussed by clinicians; this is well-recognised in some conditions such as chronic kidney disease.35 Imprecision associated with electronic patient record system coding may also be a contributory factor.36 The association of treatment burden with LTC count should therefore be interpreted with caution, but is highly plausible.

The single-item measure is acknowledged as entirely exploratory and was not subject to formal development. The item’s discriminatory ability, based on the AUC, was fair; specificity and PPV were low, but sensitivity and NPV high, for a number-line threshold ≥5, suggesting some utility in ‘ruling out’ high treatment burden, rather than in screening for high burden *per se*. It is possible that the position of the single-item relative to other questions (the item was located part-way through the survey) influenced responses to the item. Further development is clearly needed; current item formulation may provide a starting point for iterative work with patient groups.

***Comparison with existing literature***

Distribution of treatment burden was comparable to that observed during MTBQ validation in the ‘3D’ study.21 37 3D exhibited a greater proportion with high burden (27% *vs* 18%), potentially explained by a likely more multimorbid sample (from grouping of similar LTCs within selection criteria, and inclusion of severe mental health conditions), and inclusion of younger participants (≥18y *vs* ≥55y) – who tended to report greater burden. An inverse age-burden relationship was also observed among European cohorts with chronic conditions38 39 (and here, although non-significant after adjustment); this could perhaps result from balancing employment demands or caring responsibilities with LTC management, or denote differing healthcare-related expectations with age. This study did not identify an independent association with female sex noted previously.21 However, as here, during MTBQ development an association between number of LTCs and high treatment burden was observed;21 such a relationship is consistent with presumed connections between multimorbidity and treatment burden.

Making recommended lifestyle changes, and arranging appointments with health professionals, were domains most commonly generating ‘some difficulty’ – likewise observed during MTBQ development.21 This consistent finding could direct burden-reduction initiatives.

Correlation between high treatment burden and markers of workload (more pharmacological treatments, more LTCs), was observed in a Swiss cohort with multimorbidity; however, this was for GP-assessed compared with patient-perceived burden.39 Qualitative work indicates medications can contribute to burden (*e.g.* by interfering with activities, or requiring co-ordination),40 consistent with the association identified in this study with more prescribed regular medications (independent of number of LTCs).

Non-home ownership was associated with high treatment burden on univariable analysis; in the multimorbid Swiss cohort, socioeconomic deprivation was independently associated with high burden.39 A Danish study of 2,111 people with cardiovascular disease and multimorbidity also found greater treatment burden among those with difficulty understanding health information41 – consistent with findings here and suggesting that enhancing health literacy (and thereby capacity) might mitigate burden.

Associations with limited health literacy, and financial difficulty, accord with Shippee *et al’s* ‘cumulative complexity model’: lower levels of capacity to manage workload relating to greater burden.13 A mixed-methods study in the United States, however, found capacity indicators were seldom documented in medical records,42 implying under-recognition of capacity issues by clinicians: a potential barrier to prospective capacity-enhancing interventions.

Patients with multimorbidity report various strategies to lessen perceptions of burden (*e.g.* maintaining a positive attitude, normalising self-care), and notably, drawing on positive aspects of healthcare.43 Indeed provider communication and interpersonal skills (‘relational quality’) have been correlated with lower burden.44 Qualitative work with stroke professionals similarly identified communication and co-ordination, as part of individualised care, as vital to reducing treatment burden.45 This links importantly to the current study because of the finding that limited health literacy was associated with high treatment burden.

***Implications for research and practice***

Almost one-fifth of older adults with multimorbidity reported high treatment burden in this study, underlining the importance of recognising, and seeking to minimise, avoidable burden. While this study has focused on those with ≥3 documented LTCs, there remains the potential for patients with fewer conditions to also experience treatment burden. Further work is still needed to investigate changes in treatment burden over time, and impact of workload and capacity on perceived burden, adherence, and health outcomes. Research evaluating the impact of interventions that might reduce workload or enhance capacity, would also be beneficial. As of 2020, such enquiry may be facilitated by innovations stimulated by the COVID-19 pandemic, including the introduction of potentially more sustainable models of healthcare delivery.46 The increasing breadth of the social prescribing offer47 might also contribute to bolstering patient capacity. Principles of ‘minimally disruptive medicine’ will be key to reducing burden, including care co-ordination, development of clinical guidelines tailored to comorbidity, and prioritisation from the patient perspective.16 System-level healthcare solutions are required, not only those applicable at individual patient-level.

Ability to swiftly and accurately assess treatment burden is nevertheless key to optimising care, hence a single-item measure could ultimately find utility in clinical settings. Given moderate performance of the single-item measure explored here, this item should not yet be adopted into practice: further development is recommended.

Clinicians should be alert to potentially overburdened patients. Findings suggest that in addition to those with a greater number of LTCs and more prescribed regular medications, patients with limited health literacy and fewer financial resources are at increased risk of high treatment burden. Such factors indicate increased vulnerability, and reduced capacity to manage the work of looking after one’s health. GPs have a central role in incorporating these considerations into patient care for those with multimorbidity, to ensure patients are not overburdened with healthcare demands.

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**Ethical approval**

Ethical approval was granted by the University of Southampton (ERGO reference 31695), and the London - City & East Research Ethics Committee together with the Health Research Authority and Health and Care Research Wales (REC reference 18/LO/2004, IRAS reference 242816).

**Competing interests**

Polly Duncan is an investigator for an Industry-University collaboration study between the University of Bristol and Pfizer investigating the burden of lower respiratory tract infection and community acquired pneumonia in primary care. The other authors declare no competing interests.

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