

BMJ Open Underlying mechanisms of complex interventions addressing the care of older adults with multimorbidity: a realist review

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ABSTRACT

Objectives To understand *how* and *why* effective multi-chronic disease management interventions influence health outcomes in older adults 65 years of age or older.

Design A realist review.

Data sources Electronic databases including Medline and Embase (inception to December 2017); and the grey literature.

Eligibility criteria for selecting studies We considered any studies (ie, experimental quasi-experimental, observational, qualitative and mixed-methods studies) as long as they provided data to explain our programme theories and effectiveness review (published elsewhere) findings. The population of interest was older adults (age ≥65 years) with two or more chronic conditions.

Analysis We used the Realist And MEta-narrative Evidence Syntheses: Evolving Standards (RAMESES) quality and publication criteria for our synthesis aimed at refining our programme theories such that they contained multiple context-mechanism-outcome configurations describing the ways different mechanisms fire to generate outcomes. We created a 3-step synthesis process grounded in meta-ethnography to separate units of data from articles, and to derive explanatory statements across them.

Results 106 articles contributed to the analysis. We refined our programme theories to explain multimorbidity management in older adults: (1) care coordination interventions with the best potential for impact are team-based strategies, *disease management* programmes and *case management*; (2) optimised disease prioritisation involves ensuring that clinician work with patients to identify what symptoms are problematic and why, and to explore options that are acceptable to both clinicians and patients and (3) optimised patient self-management is dependent on patients' capacity for selfcare and to what extent, and establishing what patients need to enable selfcare.

Conclusions To optimise care, both clinical management and patient self-management need to be considered from multiple perspectives (patient, provider and system). To mitigate the complexities of multimorbidity management, patients focus on reducing symptoms and preserving quality of life while providers focus on the condition that most threaten morbidity and mortality.

PROSPERO registration number CRD42014014489.

Strengths and limitations of this study

- To our knowledge, this is the first realist review to explain *why* multimorbidity interventions work, *for whom*, and *under what circumstances* to improve outcomes for older adults with multimorbidity — findings can be used to inform practice and policy decisions in the management of older adults with multiple chronic conditions
- Our search strategy was in part informed by a systematic review investigating the effectiveness of multimorbidity interventions for older adults that we conducted alongside this realist review.
- We created a 3-step synthesis process drawn from meta-ethnography to separate units of data from articles, and to derive explanatory statements across them.
- Many of our included studies did not have complete data to enable optimised investigation of context-mechanism-outcome (CMO) configurations.
- Incomplete reporting also impacted our ability to fully test our theories and therefore, we could not completely elucidate the interrelationships within and between all of our CMO configurations.

BACKGROUND

The global population is ageing, with 2 billion people expected to reach 60 years of age and older by 2050.^{1 2} It is now more common for older adults to have multiple chronic diseases than to have single diseases or no chronic medical conditions at all.³ The burden of chronic disease is also on the rise globally^{1 4} with more than half of older adults (age ≥65 years) living with high-burden chronic conditions (ie, highly prevalent and associated with premature death and increased healthcare utilisation).^{3 5} Older adults also have greater healthcare needs, are at higher risk for adverse health outcomes, and experience more frequent hospitalisations,⁶ yet only 55% receive appropriate care.^{7 8} In response,

different chronic disease management (CDM) interventions have been created. For example, a programme designed to encourage older adults with Chronic Obstructive Pulmonary Disease (COPD) and depression to adhere to antidepressants and pulmonary rehabilitation.⁹ Although promising, CDM interventions have shown varying effectiveness^{10 11} in part, because they are not usually developed for older adults or created for sustained use; and very few are designed to deliberately address multimorbidity.^{8 12}

Given our rapidly ageing population, there is an urgent need to understand how and why multimorbidity interventions influence health outcomes to optimise patient care. To address these gaps, we conducted a systematic review to identify effective CDM interventions that integrate the care of ≥ 2 high-burden chronic diseases affecting older adults (published elsewhere).¹³ However, a systematic review is not always enough to inform practice and policy decisions as knowing 'what' works seldom reveals which desired outcomes may occur under different contexts. Our objective was to conduct a realist review alongside to explore the underlying mechanisms and contexts by which these CDM interventions work or do not work, for whom, under what circumstances and why.¹⁴ Realist review is particularly relevant for making sense of complex interventions (such as those focusing on CDM) that have context-sensitive outcomes. It can add important contextual and mechanistic detail to existing knowledge on this topic.¹⁵ Such detail is likely to contribute to the limited existing clinical practice guidelines on multimorbidity management such as those developed by National Institute for Health and Care Excellence (NICE),¹⁶ by explaining the contexts in which intended and unintended outcomes are likely to occur. Additional resources about realist reviews can be found the RAMESES Project website.¹⁷ Our overall objective of this review is to: understand *how* and *why* effective CDM interventions influence health outcomes in older adults 65 years of age or older.

METHODS

Study design

Our protocol was published¹⁸ and registered with PROSPERO registration number. We applied the RAMESES quality¹⁹ and reporting criteria.²⁰ The systematic review methods and findings are reported elsewhere.¹³

Programme theory development

To identify our initial programme theories (ie, what multimorbidity interventions are composed of, how and why they are expected to work and what outcomes they might generate), we used an iterative, consensus-based process. We considered two major sources to identify any published or unpublished literature²¹: (1) Medline and Google Scholar describing models, frameworks, theories of multimorbidity, CDM and complex interventions and (2) content and methods experts on our team (geriatricians, family physicians, and health services and realist

review experts). Duplicate screening of 97 reports by two reviewers identified 18 documents that contained data that helped us to understand CDM interventions. Through team discussion and a Delphi survey among our team, we identified that our initial programme theory would have to incorporate the following concepts: (1) CDM interventions are complex interventions that do provide different outcomes in different settings; (2) health prioritisation is an important aspect of multimorbidity and (3) interventions that consider patient values and circumstances, the evidence and the clinician's expertise were more likely to produce desired outcomes. We then used the data from our included studies to gradually refine our understanding of these concepts and how (if at all) they fit into our more refined programme theory developed from this review.

Search strategy

Since we performed our realist review alongside our systematic review of multimorbidity interventions,¹³ the search strategy was done simultaneously for both reviews. As such, we identified potentially relevant articles for our realist review (ie, to provide data to test our programme theories) through our systematic review search strategy (inception to December 2017)¹³ and performed additional iterative, targeted searches as needed for the realist review.¹⁹ An experienced information specialist performed these additional searches in Medline and Embase (online supplementary appendix 1).

Selection and appraisal of documents

To increase the efficiency of our searching and screening process, reviewer pairs independently screened titles and abstracts simultaneously for both the systematic review and realist review. We considered any study design for inclusion (ie, experimental quasi-experimental, observational, qualitative and mixed-methods studies). During full-text screening, we considered all articles that were identified for the systematic review as well through additional targeted searches to explain our programme theories and effectiveness review findings. Two reviewers independently assessed each article for relevance (*does the source contain any data that could be interpreted as having our relevant context, mechanism or outcome for programme theory development?*) and rigour (*How trustworthy are the data? Does the article provide enough detail on how conclusions were reached irrespective of study design?*).

Data extraction

We created and pilot tested a standardised data extraction form. Data items were driven by our purpose to refine our programme theories through context-mechanism-outcome (CMO) configurations (ie, if we were able to infer an explanation for the cause [M] for a particular outcome [O] under the influence of one or more particular contexts [C]). For example, computer-based counselling systems (intervention) targeting older adults and providers in primary care (C) are not acceptable (O) if

they do not show any relative advantage over the current system (M_1) and if inconsistent with providers' current practice workflow (M_2). After extracting excerpts in duplicate, reviewer pairs independently assigned an associated concept code and iteratively developed a codebook of concepts (online supplementary appendix 1) that was used to code subsequent excerpts; any discrepancies were discussed and resolved as a team.

Analysis and synthesis processes

We used the RAMESES quality¹⁹ and publication²⁰ criteria to guide the synthesis. Our goal was to refine our programme theories such that they contained multiple CMO configurations describing the ways different mechanisms fire to generate outcomes. We created a 3-step synthesis process grounded in meta-ethnography²² to separate units of data from articles, and to derive explanatory statements across them. *Step 1*: Reviewer pairs independently extracted relevant excerpts from articles. *Step 2*: One reviewer sorted excerpts by concept for each study and developed consolidated statements (groups of CMO configurations) for each. A second reviewer audited the first reviewer's statements by checking for agreement and consistency with their own interpretations. *Step 3*: As a team, we examined and compared consolidated statements across studies to derive explanatory statements. These were then used to refine our *programme theories* aimed at explaining the outcome patterns we found within the effectiveness review. When the consolidated statements seemed to disagree, we unpacked the concepts and further examined them, consulting our literature and content experts as necessary for additional data and insights.

Deviations from our protocol in conducting our realist review

We followed the methods as outlined in our protocol¹⁸ with a few exceptions. First, we switched to an auditing process during *Step 2* of the analysis to make our process more efficient. This involved an auditor checking the work of a primary reviewer. Second, since our process to finalise the list of initial programme theories identified an area that was not covered by our systematic review search (ie, health prioritisation), we added a secondary search strategy to capture this literature as described above.

Patient and public involvement

Patients were not involved in the conduct of the review but older adults with multiple chronic conditions are involved in developing key messages for this research. These patients are also part of our broader integrated knowledge translation team to co-design an electronic self-management tool that integrates the care of multiple chronic conditions (KeepWell); this tool is being informed by this review.

RESULTS

Study characteristics

Figure 1 is our Preferred Reporting Items for Systematic Reviews and Meta-Analyses diagram, which shows the

flow of article selection. Of 2435 potentially, relevant citations that were screened for relevance, 124 articles were reviewed in full-text, and 106 articles contributed to the analysis.^{3 9 15 23–125} Studies were published between 2002 and 2016 mostly in the USA (n=32), the UK (n=19), Canada (n=14), Germany (n=11) and Australia (n=10). Most of the articles (75%) were about multimorbidity (n=50) or disease prioritisation (n=29), and 27 studies (25%) addressed specific chronic disease combinations.

Programme theories

Using data from our included studies, we iteratively developed and refined our initial two programme theories and a third programme theory that emerged from our data. To make our findings more succinct, in the following paragraphs, we have provided narratives that summarise the most important aspects of our programme theories. This approach obscures the detailed CMO configurations that underpin these narratives and may make our manuscript less useful for those interested in realist review methodology. To address this issue, we have provided indications of the CMO configurations that our narratives are based on. For those interested in seeing the links between our data and CMO configurations, please see online supplementary appendices 3–6 that explains the outcomes that may be achieved by the different intervention strategies used in care coordination under different contexts.

Programme theory 1: Care coordination interventions for multimorbidity management

Almost one-half of the interventions described in our realist review were 'care coordination' interventions (ie, changes in how healthcare workers interact with each other or patients to ensure timely and efficient delivery of healthcare).¹²⁶ Online supplementary appendix 3 shows their detailed CMO configurations that underpin this programme theory. Overall, we found that care coordination interventions in primary care are effective for older adults with multimorbidity because they represent a structured approach to holistic care. They address multiple conditions through interdisciplinary teams or multidisciplinary disease management, providing specific processes for communication and establishing formal roles for providers and patients. We identified three types of care coordination approaches that healthcare providers may wish to use that have potential for impact: (1) *Team-based* or collaborative approaches involve highly trained clinicians⁵³ providing holistic and coordinated care⁸⁸ including spending time with patients to discuss all their concerns, and to prevent care overlap and gaps.⁸⁰ Patients are given education, counselling and other support services to address their disease(s), medications, and lifestyle.⁴⁴ Team-based approaches can provide access to specialists⁵³ and a wider range of services, and provide evidence-based care solutions for multiple conditions in parallel (not in tandem).³⁸ Optimised care outcomes are most likely to occur through interdisciplinary communication and collaboration,^{38 81} when teams comprise highly trained and skilled members⁵³ who understand and accept

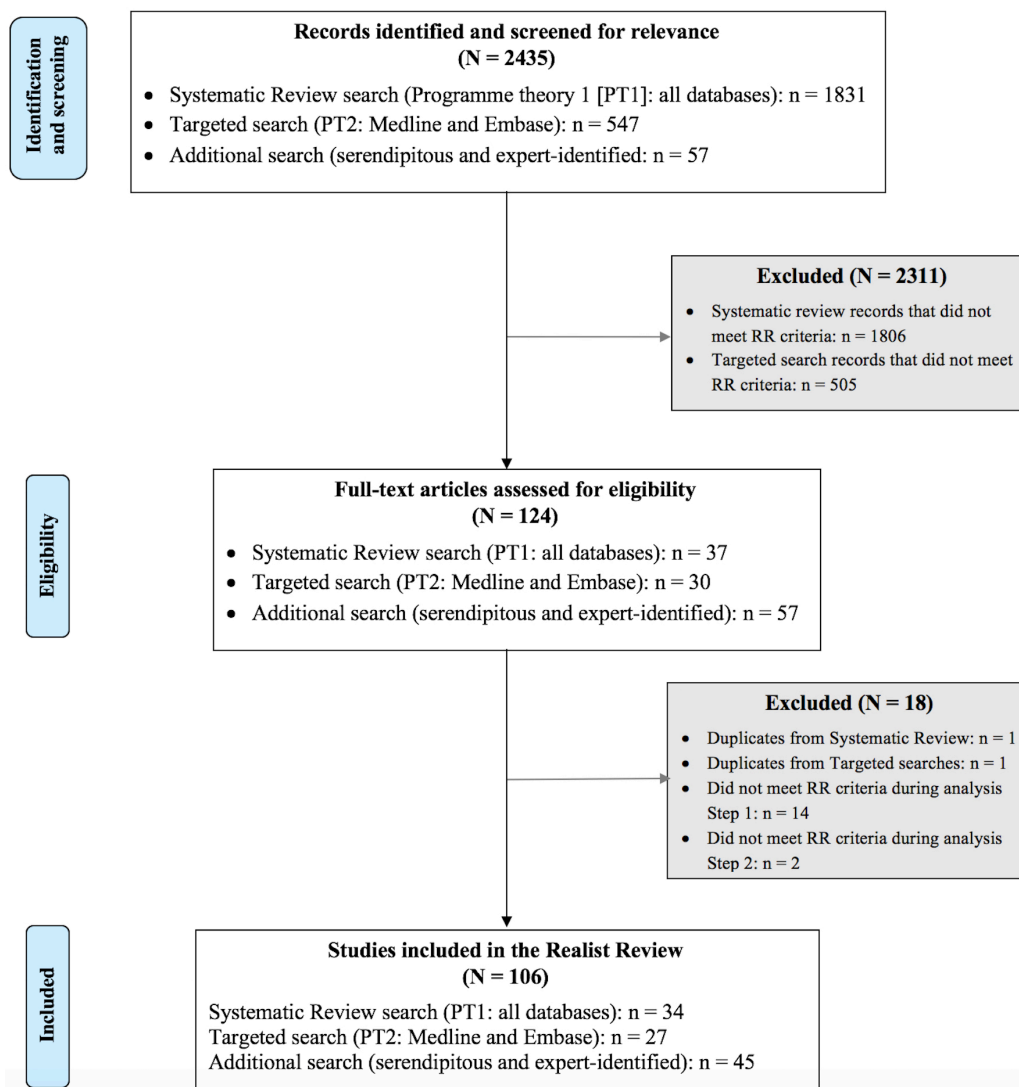


Figure 1 Flow of article selection for the Realist Review.

each other's roles,⁵³ provide opportunities^{38 88} and time⁵³ to share information,⁸¹ and collaborate on patient care.^{38 45 53 88} Other contexts in which mechanisms are likely to be triggered include teams that have dedicated members who provide additional support to patients^{38 53} or providers,⁸¹ receive training,^{38 53 81} and have a robust and well-functioning communication system.^{38 45} (2) *Disease management* programmes follow a 'script' for how to provide effective patient care via care protocols or plans, which define the division of tasks, support the follow-up and coordination of action,^{103 110} and help to sustain a philosophy of common care.⁴⁵ Systematised care is achieved through checklists, follow-up timetables^{45 103 110} and treatment targets,⁴⁵ which can lead to a shared philosophy of care^{45 103} and optimised decision making.⁴⁵ (3) *Case management*: Case managers are trained healthcare professionals who are the main contact (and conduit of information) between a patient and involved providers,⁵³ and most appropriate for multimorbidity management when there may be multiple and diverse providers involved in a patient's care. When case managers are the primary contact,^{80 103} care is perceived by

patients as continuous,^{78 79} coordinated⁷⁹ and more individualised,^{9 80} and fosters the development of the skills and confidence patients need to self-manage their health.⁷⁸

Programme theory 2: Disease prioritisation in multimorbidity management

The detailed CMO configurations of disease prioritisation that underpin this programme theory are described in online supplementary appendix 4. Multimorbidity management is perceived as confusing for patients and overwhelming for providers due to the heterogeneous nature of multimorbidity,¹⁰² disease and treatment interactions and possible conflicts,^{57 92} and the difficulty of attributing symptoms to conditions.⁵⁷ Multimorbidity can create a cognitive and emotional overload in patients and providers,⁶⁴ so a common strategy they use is to focus on one condition at a time. Patients and providers focus their attention by prioritising one condition over another for a specified period of time, or until particular outcomes are achieved.^{64 91} However, patients and providers approach prioritisation differently. Patients

make prioritisation judgements based on the symptoms they experience and need the most attention. They identify the most undesired symptoms and focus on their associated condition(s)^{32 56 63 66 68 125} or those that threaten their social activities,^{25 63 76} limit their independence^{25 91} and have potentially severe long-term consequences if not addressed.^{63 91} Providers prioritise conditions based on their judgements about the prognosis or severity of the condition and place greater emphasis on conditions with more serious outcomes^{25 57 66 68 76 125}; they focus on conditions that threaten a patient's morbidity and mortality,^{25 57 66 68 125} those they think they are better equipped to address (eg, physical over emotional^{32 124}), and whether the patient is likely to benefit from treatment.^{57 114 124 125} What's common among patients and providers, is that they both consider conditions that they feel *capable* of addressing,^{64 91 124 125} and both consider the cascading effects of multimorbidity and the interrelatedness of these conditions during the prioritisation process.^{65 91} For patients, the cascading effects of multimorbidity are particularly challenging. Patients may find it difficult to determine which chronic disease is causing

a particular symptom because conditions may share similar symptoms⁷² or the treatment of one condition may aggravate the other^{61 62 90 91} or cause other antagonistic effects.^{64 90 91} Self-management is therefore a challenge for patients because the diagnosis of (and receipt of information) about a new condition compounds the complexity and uncertainty of what to do.⁸⁷ Figure 2 shows our conceptualisation of optimised disease prioritisation from the perspective of providers and patients. For this simplified overall programme theory, we have analysed and interpreted our findings in such a way as to provide a programme theory that presents out findings in a more familiar format using the concepts of 'barriers' and 'facilitators'. The programme theory sets out the factors that need to be taken into account if providers and patients wish to optimise disease prioritisation. In particular we provide an overview of factors that healthcare providers may need to address to help patients to: (1) identify what symptoms are bothering them; (2) why they bother them and (3) exploring options that are acceptable to them for addressing their symptoms.

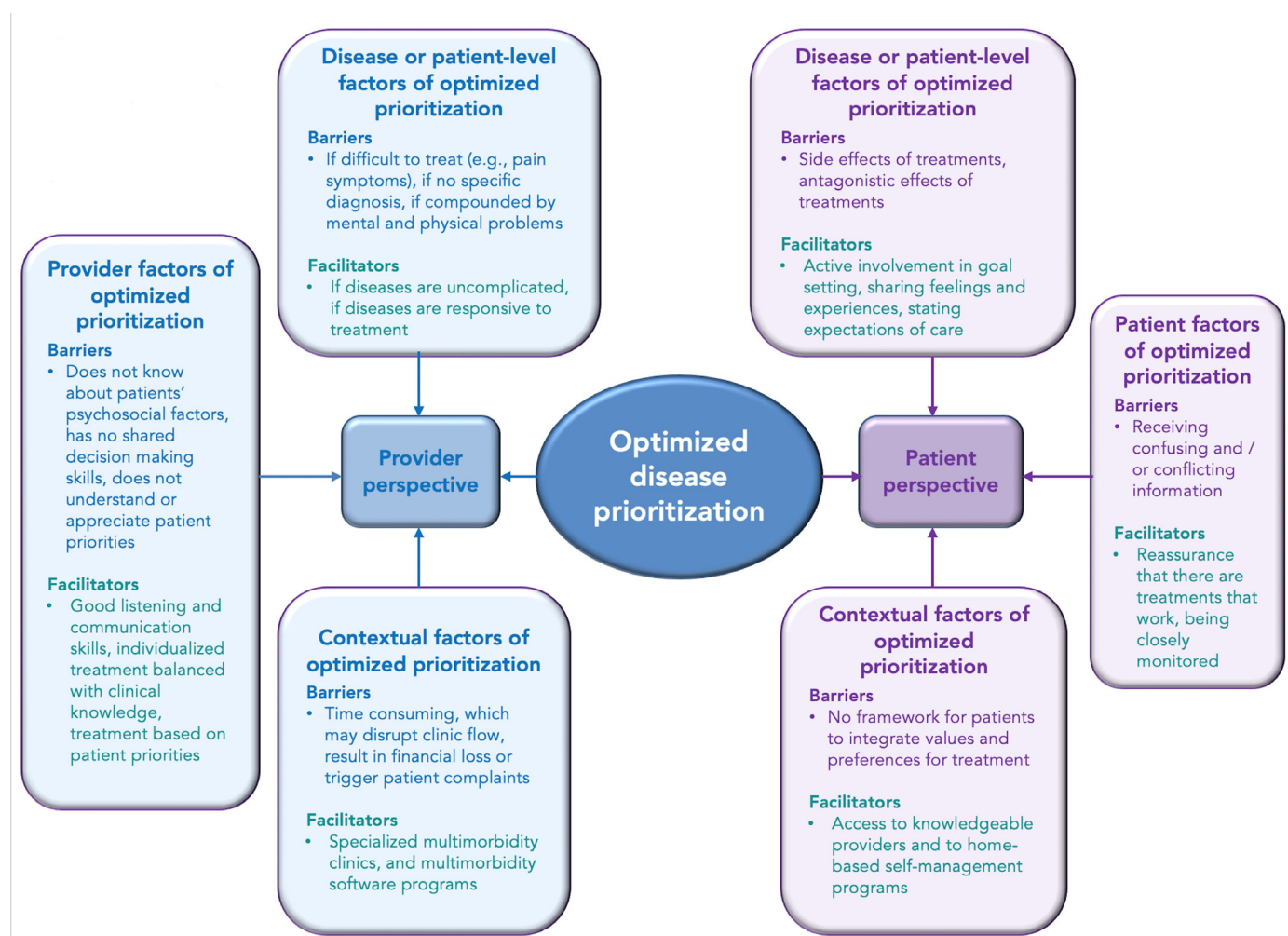


Figure 2 Framework of optimised disease prioritization in multimorbidity management. A simplified overarching programme theory of identifying factors (conceptualised as barriers and facilitators) that need to be considered by patients and providers when trying to optimise disease prioritization.

Programme theory 3: Patient self-management in multimorbidity

The detailed CMO configurations of multimorbidity self-management that underpin this programme theory are in online supplementary appendix 5. Multimorbidity is perceived by patients as a burden because of the volume of information and recommendations provided^{51 74} which are often inconsistent or conflicting, and the cognitive and emotional overload required to assimilate this information or to make lifestyle changes.⁸⁷ Subsequently, this can lead to confusion and non-adherence to recommendations^{25 43 91–93} and may also trigger cognitive and emotional overload. Specific explanations to these outcomes include (1) self-management regimens are designed to fit their condition rather than their health priorities, lifestyle and available resources^{89 94}; (2) prescribed medications are unwieldy (too many, taken often, and difficult to keep track of)^{15 51} or mismanaged⁷¹; (3) difficulties with following the required diet and exercise routine^{36 51 91}; and to see multiple providers⁷¹; (4) not knowing how to respond to adverse drug effects^{15 71} and (5) experiencing communication barriers due to linguistic and cultural diversity.⁷¹ Self-management is especially challenging for older adults with cognitive impairment⁸⁹ or anxiety⁹⁰ in addition to other chronic conditions, as these contexts can interact to increase people's perceived illness burden.⁶³ In particular, if depression is the additional condition, older adults may choose not to do anything at all because they either consider it a normal part of ageing or reluctant to seek treatment due to the stigma associated with mental health problems.³⁰ Depression, as a context, can therefore also trigger additional mechanisms that reduce a patient's ability to self-manage chronic conditions^{30–32 59 64 87 91}: reduced motivation, energy, self-efficacy and feelings of hopelessness,³¹ and stress.⁸⁷ A number of feedback loops are activated because illness burden can interfere with a person's ability to engage in health promotion (eg, exercise). This can lead to negative consequences (eg, weight gain,⁸⁷ reduced quality of life, functional decline), and in turn impair mood, social networks, and self-management behaviours.⁶² Multimorbidity self-management is also influenced by the lack of available resources⁶⁴ (eg, adequate finances,^{62 91} social supports^{23 62 88 89 91} or transportation⁹¹) or low health literacy²⁹ or skills to manage adverse effects.^{43 90} Older adults are interested in self-management tools that provide health condition information⁵¹; share, coordinate and synthesise information with and between providers; and connect them with other patients.⁵¹ Physicians can support this by tailoring information to the stage of the patient's condition,²⁶ having interactions with patients,⁹³ providing information⁹³ and fostering a collaborative approach to care.¹¹⁵

DISCUSSION

In this realist review we developed and refined our programme theories to explain why coordination of care interventions (found to have the most potential for impact in our systematic review) work to improve outcomes for

older adults with multimorbidity. Care coordination interventions may be effective in primary care because they represent a structured approach to comprehensive care, and address multiple conditions through interdisciplinary teams or multidisciplinary disease management by providing specific processes for communication, and establishing formal roles for providers and patients. *Team-based approaches* provide the right care at the right time, *disease management* offers a systematised approach to care, and *case management* offers a dedicated case manager as the conduit of care.

In addition to refining our programme theories, we generated explanations associated with these theories. Online supplementary appendix 6 shows the CMO configurations to explain of multimorbidity management overall. **Figure 3** shows our conceptualisation of multimorbidity management, which suggests that optimised care requires both clinical management and patient self-management, with the caveat that each needs to consider identified challenges from the perspective of those affected by them (patient, provider, system). From the patient perspective, clinical management can be confusing due to conflicting messages, which is compounded in the presence of depression, impaired cognition, or poor health literacy. The mental health needs of patients can further complicate clinical management by impeding selfcare, creating communication barriers with providers (eg, patient complaints may not be clear), and patients receiving less intensive treatment. Self-management is difficult for patients because of the high burden of required lifestyle changes and adherence to multiple and often conflicting treatment regimens. Multimorbidity can also have cascading effects due to the nature of how chronic diseases are interrelated and the influence of a patient's mental and emotional health on self-management. From the provider perspective, clinical management of multimorbidity may be perceived as overwhelming because of the heterogeneous nature of multimorbidity, and conflicting or lack of evidence to guide clinical decision making. Lack of skills and confidence, not having decision support systems and protocols that are too rigid can also lead to inadequate preparation to manage multimorbidity. From a system perspective, even if primary care is the optimal setting for multimorbidity management, it may not always have the infrastructure to support optimal strategies such as care coordination and can also lead to fragmentation of care.

Recommendations

Findings from *programme theory 1* suggests that healthcare providers may wish to use care coordination interventions that are: (1) *Team-based* or collaborative approaches that involve highly trained clinicians providing holistic and coordinated care through effective interdisciplinary communication and collaboration, and the provision of education and counselling to patients to address their disease(s), medications and lifestyle; (2) *Disease management* programmes via care protocols or plans, checklists,

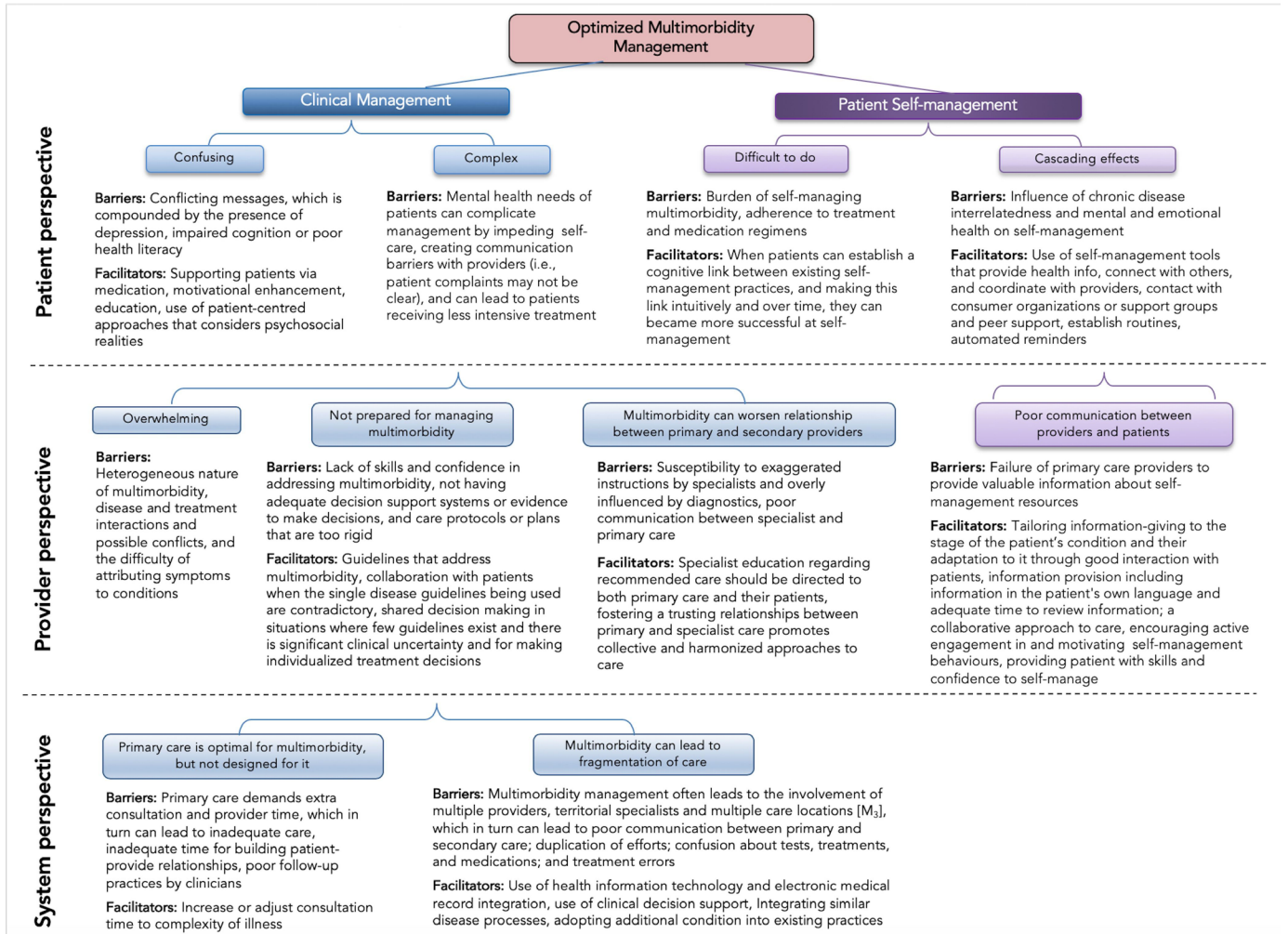


Figure 3 Framework of optimised multimorbidity management . A simplified overarching programme theory identifying factors (conceptualised as barriers and facilitators) that need to be considered when trying to optimise multimorbidity management from the patient, provider and system perspective.

follow-up timetables and treatment targets and (3) *Case management* strategies for situations when there may be multiple and diverse providers involved in a patient's care. For *programme theory 2*, the specific types of disease prioritisation approach that healthcare providers may wish to consider is to work with patients to identify what symptoms are bothering them and why, and exploring options that are acceptable to both clinicians and patients for addressing their symptoms. For *programme theory 3*, the specific types of self-management approach that healthcare providers may wish to consider include not assuming that all patients are capable of selfcare, identifying who is capable of selfcare and to what extent, and establishing with the patient what they need (eg, information, support) to enable selfcare.

Strengths and limitations

To our knowledge, this is the first realist review investigating older adult multimorbidity aimed at explaining *why* effective multi-CDM interventions (identified through a systematic review¹³) work/do not work for whom, under what circumstances and why. This can

better inform practice and policy decisions about multimorbidity management than a systematic review alone. A Cochrane review investigated interventions in multimorbid patients of any age¹⁵ and found mixed results, but concluded that interventions that were integrated with care and targeted specific risk factors or functional difficulties may be more effective.¹⁵ A rapid realist review investigating the underlying mechanisms of care planning strategies found that the mechanisms driving positive outcomes for people with long-term conditions are those that motivate them and promote an understanding of their role in self-management and how their lifestyle affects their conditions.¹²⁷ Our findings build on these studies by providing *explanations* for why multimorbidity interventions may be effective for older adults. Additionally, we focused exclusively on older adults because they represent a relatively unstudied population, and given their projected population growth, they urgently need our attention to optimise their care. NICE guidelines on clinical assessment and management of multimorbidity¹⁶ (one of few existing multimorbidity guidelines) support

many of our findings. They emphasise the need to find synergies in care regimes and simplifying care where possible. They also describe a preferred approach to care, which involves establishing patient goals, values and priorities, where patients are encouraged to describe their preferred decision making approach and what aspects of their life they prioritise.¹⁶ A recent qualitative systematic review also highlights the need for providers to simplify the burden of care for multimorbid patients.¹²⁸ Our findings highlight the importance of focusing multimorbidity management by prioritising one or more specific condition(s) and ensuring that prioritisation is undertaken in collaboration with patients.

Our study has some limitations. First, it is possible that other teams may have identified different programme theories or interpretations. However, we used a rigorous and systematic process, and we let our data guide our interpretations. Second, many of our included studies did not have complete data to enable optimised CMO investigations. This may in part be due to an over-emphasis on effectiveness research in the literature, and an under-representation of qualitative inquiry, particularly about elucidating ‘mechanisms’. For example, the literature rarely addressed the social determinants of health (a potentially significant trigger for multimorbidity outcomes) even though many older adults experience social isolation¹²⁹ and financial¹³⁰ challenges. Incomplete reporting also impacted our ability to fully test our theories. As such, while we developed and refined a number of explanations for our data, we could not completely elucidate the interrelationships within and between all of our CMO configurations. Finally, it is important to note that since this analysis was interpretive and inductive, it is possible that another team of researchers would have arrived at a different set of programme theories that incorporate the mechanisms and contexts of multi-CDM interventions for older adults. Thus, these findings should only be used as potential mid-range theories to explore and interrogate.

CONCLUSIONS AND FUTURE DIRECTIONS

Our realist review contributes to the current, limited knowledge of the underlying mechanisms of complex multi-CDM interventions for older adults with multimorbidity. We found that care coordination interventions are effective because they represent a structured approach to holistic care. To mitigate the complexities of multimorbidity management, patients focus on reducing their undesired symptoms and preserving their quality of life, while providers focus on the condition that most threaten a patient’s morbidity and mortality. To optimise care, multimorbidity management requires both clinical management and patient self-management, and be considered from multiple perspectives (patient, provider and system).

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REFERENCES

1. Chatterji S, Byles J, Cutler D, *et al*. Health, functioning, and disability in older adults—present status and future implications. *The Lancet* 2015;385:563–75.
2. Statistics_Canada. Canada Yearbook. Seniors. 2012 <http://www.statcan.gc.ca/pub/11-402-x/2012000/chap/seniors-aines/seniors-aines-eng.htm> (Accessed 8th May 2017).
3. Marengoni A, Angleman S, Melis R, *et al*. Aging with multimorbidity: a systematic review of the literature. *Ageing Res Rev* 2011;10:430–9.
4. Yach D, Hawkes C, Gould CL, *et al*. The global burden of chronic diseases: overcoming impediments to prevention and control. *JAMA* 2004;291:2616–22.

5. WHO. NCDs | *Noncommunicable diseases and their risk factors*. WHO Web site: World Health Organization. Accessed. <http://www.who.int/ncds/en/>. Published 2018. Updated 2018-03-20 14:55:41
6. Boyd C, Fortin M. Future of multimorbidity research: How should understanding of multimorbidity inform health system design? *Public Health Reviews* 2011;33:451–74.
7. Moore EG, Rosenberg MW, Fitzgibbon SH. Activity limitation and chronic conditions in Canada's elderly, 1986–2011. *Disabil Rehabil* 1999;21:196–210.
8. Ward BW, Schiller JS. Prevalence of multiple chronic conditions among US adults: estimates from the National Health Interview Survey, 2010. *Prev Chronic Dis* 2013;10:E65.
9. Alexopoulos GS, Kioussis DN, Sirey JA, et al. Untangling therapeutic ingredients of a personalized intervention for patients with depression and severe COPD. *Am J Geriatr Psychiatry* 2014;22:1316–24.
10. Weingarten SR, et al. Interventions used in disease management programmes for patients with chronic illness---which ones work? Meta-analysis of published reports. *BMJ* 2002;325:925.
11. Wenger NS, Solomon DH, Roth CP, et al. The quality of medical care provided to vulnerable community-dwelling older patients. *Ann Intern Med* 2003;139:740–7.
12. Coleman K, Austin BT, Brach C, et al. Evidence on the chronic care model in the new millennium. *Health Aff* 2009;28:75–85.
13. Kastner M, Cardoso R, Lai Y, et al. Effectiveness of interventions for managing multiple high-burden chronic diseases in older adults: a systematic review and meta-analysis. *CMAJ* 2018;190:E1012–E1004–.
14. Greenhalgh T, Peacock R. Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources. *BMJ* 2005;331:1064–5.
15. Smith SM, Wallace E, O'Dowd T, et al. Interventions for improving outcomes in patients with multimorbidity in primary care and community settings. *Cochrane Database Syst Rev* 2016;3:CD006560.
16. Centre NG. (Great Britain), National Institute for Health and Care Excellence (Great Britain). Multimorbidity: assessment, prioritisation, and management of care for people with commonly occurring multimorbidity: clinical assessment and management. *NICE guideline: methods, evidence and recommendations NG56*. London: National Institute for Health and Care Excellence, 2016.
17. Project R. The RAMESES Projects. 2013 <http://www.ramesesproject.org/> (Accessed 29 November, 2018.).
18. Kastner M, Perrier L, Hamid J, et al. Effectiveness of knowledge translation tools addressing multiple high-burden chronic diseases affecting older adults: protocol for a systematic review alongside a realist review. *BMJ Open* 2015;5:e007640.
19. Wong G, Greenhalgh T, Westhrop G, et al. *Development of methodological guidance, publication standards and training materials for realist and meta-narrative reviews: the RAMESES (Realist And Meta-narrative Evidence Syntheses 2013 Evolving Standards) project*. Southampton, UK: NIHR Journals Library, 2014.
20. Wong G, Greenhalgh T, Westhrop G, et al. RAMESES publication standards: realist syntheses. *BMC Med* 2013;11:21.
21. Pawson R, Greenhalgh T, Harvey G, et al. Realist review--a new method of systematic review designed for complex policy interventions. *J Health Serv Res Policy* 2005;10:21–34.
22. Noblit G, Hare R. *Meta-ethnography: Synthesizing qualitative studies*. Newbury Park, CA: Sage, 1988.
23. Webster F, Christian J, Mansfield E, et al. Capturing the experiences of patients across multiple complex interventions: a meta-qualitative approach. *BMJ Open* 2015;5:e007664.
24. Sun X, Guyatt GH. Interventions to enhance self management support. *BMJ* 2013;346:f3949.
25. Junius-Walker U, Voigt I, Wrede J, et al. Health and treatment priorities in patients with multimorbidity: report on a workshop from the European general practice network meeting 'research on multimorbidity in general practice'. *Eur J Gen Pract* 2010;16:51–4.
26. Infante FA, Proudfoot JG, Powell Davies G, et al. How people with chronic illnesses view their care in general practice: a qualitative study. *Med J Aust* 2004;181:70–3.
27. Naik AD, White CD, Robertson SM, et al. Behavioral health coaching for rural-living older adults with diabetes and depression: an open pilot of the HOPE Study. *BMC Geriatr* 2012;12:37.
28. Lamers F, Jonkers CC, Bosma H, et al. A minimal psychological intervention in chronically ill elderly patients with depression: a randomized trial. *Psychother Psychosom* 2010;79:217–26.
29. Kenning C, Protheroe J, Gray N, et al. The potential for using a Universal Medication Schedule (UMS) to improve adherence in patients taking multiple medications in the UK: a qualitative evaluation. *BMC Health Serv Res* 2015;15:94.
30. Unützer J, Hantke M, Powers D, et al. Care management for depression and osteoarthritis pain in older primary care patients: a pilot study. *Int J Geriatr Psychiatry* 2008;23:1166–71.
31. Cj W, Chang AM, Courtney M, et al. Peer supporters for cardiac patients with diabetes: a randomized controlled trial. *Int Nurs Rev* 2012;59:345–52.
32. Zulman DM, Kerr EA, Hofer TP, et al. Patient-provider concordance in the prioritization of health conditions among hypertensive diabetes patients. *J Gen Intern Med* 2010;25:408–14.
33. Kennedy A, Bower P, Reeves D, et al. Implementation of self management support for long term conditions in routine primary care settings: cluster randomised controlled trial. *BMJ* 2013;346:f2882.
34. McSweeney K, Jeffreys A, Griffith J, et al. Specialist mental health consultation for depression in Australian aged care residents with dementia: a cluster randomized trial. *Int J Geriatr Psychiatry* 2012;27:1163–71.
35. Williams JW, Katon W, Lin EH, et al. The effectiveness of depression care management on diabetes-related outcomes in older patients. *Ann Intern Med* 2004;140:1015–24.
36. Eijkelberg IM, Mur-Veeman IM, Spreeuwenberg C, et al. Patient focus groups about nurse-led shared care for the chronically ill. *Patient Educ Couns* 2002;47:329–36.
37. Fraccaro P, Arguello Casteleiro M, Ainsworth J, et al. Adoption of clinical decision support in multimorbidity: a systematic review. *JMIR Med Inform* 2015;3:e4.
38. Knowles SE, Chew-Graham C, Adeyemi I, et al. Managing depression in people with multimorbidity: a qualitative evaluation of an integrated collaborative care model. *BMC Fam Pract* 2015;16:32.
39. Ricci-Cabello I, Violán C, Foguet-Boreu Q, et al. Impact of multimorbidity on quality of healthcare and its implications for health policy, research and clinical practice. A scoping review. *Eur J Gen Pract* 2015;21:192–202.
40. Smith SM, O'Kelly S, O'Dowd T. GPs' and pharmacists' experiences of managing multimorbidity: a 'Pandora's box'. *British Journal of General Practice* 2010;60:e285–94.
41. Koné Pefoyo AJ, Bronskill SE, Gruneir A, et al. The increasing burden and complexity of multimorbidity. *BMC Public Health* 2015;15:415.
42. Brodaty H, Draper BM, Millar J, et al. Randomized controlled trial of different models of care for nursing home residents with dementia complicated by depression or psychosis. *J Clin Psychiatry* 2003;64:63–72.
43. Hammill AC, Wilson MG. *Rapid synthesis: comparing multi-component chronic-disease programs to disease-specific programs*. Hamilton, Ontario: McMaster University, 2015.
44. Müller-Staub M, Zigan N, Händler-Schuster D, et al. [Being cared for and caring: living with multiple chronic diseases (Leila)-a qualitative study about APN contributions to integrated care]. *Pflege* 2015;28:79–91.
45. Lamothe L, Sylvain C, Sit V. [Multimorbidity and primary care: emergence of new forms of network organization]. *Sante Publique* 2015;27:S129–35.
46. Schnipper JL, Linder JA, Palchuk MB, et al. Effects of documentation-based decision support on chronic disease management. *Am J Manag Care* 2010;16:SP72–81.
47. Rahimpour M, Lovell NH, Celler BG, et al. Patients' perceptions of a home telecare system. *Int J Med Inform* 2008;77:486–98.
48. Bowles KH, Holland DE, Horowitz DA. A comparison of in-person home care, home care with telephone contact and home care with telemonitoring for disease management. *J Telemed Telecare* 2009;15:344–50.
49. Whitten P, Mickus M. Home telecare for COPD/CHF patients: outcomes and perceptions. *J Telemed Telecare* 2007;13:69–73.
50. Noel HC, Vogel DC, Erdos JJ, et al. Home telehealth reduces healthcare costs. *Telemed J E Health* 2004;10:170–83.
51. Zulman DM, Jenchura EC, Cohen DM, et al. How Can eHealth technology address challenges related to multimorbidity? perspectives from patients with multiple chronic conditions. *J Gen Intern Med* 2015;30:1063–70.
52. Becker A, Herzberg D, Marsden N, et al. A new computer-based counselling system for the promotion of physical activity in patients with chronic diseases--results from a pilot study. *Patient Educ Couns* 2011;83:195–202.
53. Wozniak L, Soprovich A, Rees S, et al. Contextualizing the effectiveness of a collaborative care model for primary care patients with diabetes and depression (Teamcare): a qualitative assessment using RE-AIM. *Can J Diabetes* 2015;39:S83–91.

54. Osborn R, Moulds D, Schneider EC, *et al.* Primary care physicians in ten countries report challenges caring for patients with complex health needs. *Health Aff* 2015;34:2104–12.
55. Williams A, Manias E, Walker R, *et al.* A multifactorial intervention to improve blood pressure control in co-existing diabetes and kidney disease: a feasibility randomized controlled trial. *J Adv Nurs* 2012;68:2515–25.
56. Muth C, van den Akker M, Blom JW, *et al.* The Ariadne principles: how to handle multimorbidity in primary care consultations. *BMC Med* 2014;12:223.
57. Luijckx HD, Loeffen MJ, Lagro-Janssen AL, *et al.* GPs' considerations in multimorbidity management: a qualitative study. *Br J Gen Pract* 2012;62:e503–10.
58. Sinnott C, Mc Hugh S, Browne J, *et al.* GPs' perspectives on the management of patients with multimorbidity: systematic review and synthesis of qualitative research. *BMJ Open* 2013;3:e003610.
59. Bayliss EA, Edwards AE, Steiner JF, *et al.* Processes of care desired by elderly patients with multimorbidities. *Fam Pract* 2008;25:287–93.
60. Søndergaard E, Willadsen TG, Guassora AD, *et al.* Problems and challenges in relation to the treatment of patients with multimorbidity: General practitioners' views and attitudes. *Scand J Prim Health Care* 2015;33:121–6.
61. Smith SM, O'Dowd T. Chronic diseases: what happens when they come in multiples? *Br J Gen Pract* 2007;57:268–70.
62. Koch G, Wakefield BJ, Wakefield DS. Barriers and facilitators to managing multiple chronic conditions: a systematic literature review. *West J Nurs Res* 2015;37:498–516.
63. Cheraghi-Sohi S, Morden A, Bower P, *et al.* Exploring patient priorities among long-term conditions in multimorbidity: A qualitative secondary analysis. *SAGE Open Med* 2013;1:205031211350395.
64. Cheraghi-Sohi S, Bower P, Kennedy A, *et al.* Patient priorities in osteoarthritis and comorbid conditions: a secondary analysis of qualitative data. *Arthritis Care Res* 2013;65:920–7.
65. Bower P, Macdonald W, Harkness E, *et al.* Multimorbidity, service organization and clinical decision making in primary care: a qualitative study. *Fam Pract* 2011;28:579–87.
66. Löffler C, Altiner A, Streich W, *et al.* [Approaches of general practitioners and patients to multimorbidity. Qualitative study]. *Z Gerontol Geriatr* 2015;48:452–6.
67. Boulton C, Karm L, Groves C. Improving chronic care: the "guided care" model. *Perm J* 2008;12:50–4.
68. Hansen H, Pohontsch N, van den Bussche H, *et al.* Reasons for disagreement regarding illnesses between older patients with multimorbidity and their GPs – a qualitative study. *BMC Fam Pract* 2015;16:68.
69. Onder G, Palmer K, Navickas R, *et al.* Time to face the challenge of multimorbidity. A European perspective from the joint action on chronic diseases and promoting healthy ageing across the life cycle (JA-CHRODIS). *Eur J Intern Med* 2015;26:157–9.
70. van den Bussche H, Koller D, Kolonko T, *et al.* Which chronic diseases and disease combinations are specific to multimorbidity in the elderly? Results of a claims data based cross-sectional study in Germany. *BMC Public Health* 2011;11:101.
71. Williams A, Manias E, Liew D, *et al.* Working with CALD groups: testing the feasibility of an intervention to improve medication self management in people with kidney disease, diabetes, and cardiovascular disease. *Renal Society of Australasia Journal* 2012;8:62–9.
72. Zulman DM, Asch SM, Martins SB, *et al.* Quality of care for patients with multiple chronic conditions: the role of comorbidity interrelatedness. *J Gen Intern Med* 2014;29:529–37.
73. Sinnott C, Hugh SM, Boyce MB, *et al.* What to give the patient who has everything? A qualitative study of prescribing for multimorbidity in primary care. *Br J Gen Pract* 2015;65:e184–91.
74. Vogeli C, Shields AE, Lee TA, *et al.* Multiple chronic conditions: prevalence, health consequences, and implications for quality, care management, and costs. *J Gen Intern Med* 2007;22:391–5.
75. Wallace E, Salisbury C, Guthrie B, *et al.* Managing patients with multimorbidity in primary care. *BMJ* 2015;350:h176.
76. Junius-Walker U, Stolberg D, Steinke P, *et al.* Health and treatment priorities of older patients and their general practitioners: a cross-sectional study. *Qual Prim Care* 2011;19:67–76.
77. Boyd CM, Boulton C, Shadmi E, *et al.* Guided care for multimorbid older adults. *Gerontologist* 2007;47:697–704.
78. Hjelm M, Holmgren AC, Willman A, *et al.* Family members of older persons with multi-morbidity and their experiences of case managers in Sweden: an interpretive phenomenological approach. *Int J Integr Care* 2015;15:e011.
79. Hjelm M, Holst G, Willman A, *et al.* The work of case managers as experienced by older persons (75+) with multi-morbidity – a focused ethnography. *BMC Geriatr* 2015;15:168.
80. Sporensberg SL, Wynia K, Fokkens AS, *et al.* Experiences of community-living older adults receiving integrated care based on the chronic care model: a qualitative study. *PLoS One* 2015;10:e0137803.
81. Lee L, Heckman G, McKelvie R, *et al.* Physicians' perceptions of capacity building for managing chronic disease in seniors using integrated interprofessional care models. *Can Fam Physician* 2015;61:e148–57.
82. Moffat K, Mercer SW. Challenges of managing people with multimorbidity in today's healthcare systems. *BMC Fam Pract* 2015;16:129.
83. Sinnige J, Braspenning J, Schellevis F, *et al.* The prevalence of disease clusters in older adults with multiple chronic diseases—a systematic literature review. *PLoS One* 2013;8:e79641.
84. Smith SM, Soubhi H, Fortin M, *et al.* Managing patients with multimorbidity: systematic review of interventions in primary care and community settings. *BMJ* 2012;345:e5205.
85. Coventry PA, Small N, Panagioti M, *et al.* Living with complexity; marshalling resources: a systematic review and qualitative meta-synthesis of lived experience of mental and physical multimorbidity. *BMC Fam Pract* 2015;16:171.
86. Tinetti ME, Bogardus ST, Agostini JV. Potential pitfalls of disease-specific guidelines for patients with multiple conditions. *N Engl J Med* 2004;351:2870–4.
87. Lindsay S. Prioritizing illness: lessons in self-managing multiple chronic diseases. *Canadian Journal of Sociology* 2009;34:983–1002.
88. Tracy CS, Bell SH, Nickell LA, *et al.* The IMPACT clinic: innovative model of interprofessional primary care for elderly patients with complex health care needs. *Can Fam Physician* 2013;59:e148–55.
89. Fried TR, Tinetti ME, Iannone L. Primary care clinicians' experiences with treatment decision making for older persons with multiple conditions. *Arch Intern Med* 2011;171:75–80.
90. Liddy C, Blazkho V, Mill K. Challenges of self-management when living with multiple chronic conditions: systematic review of the qualitative literature. *Can Fam Physician* 2014;60:1123–33.
91. Bratzke LC, Muehrer RJ, Kehl KA, *et al.* Self-management priority setting and decision-making in adults with multimorbidity: a narrative review of literature. *Int J Nurs Stud* 2015;52:744–55.
92. Harris MF, Dennis S, Pillay M. Multimorbidity: negotiating priorities and making progress. *Aust Fam Physician* 2013;42:850–4.
93. Morris RL, Sanders C, Kennedy AP, *et al.* Shifting priorities in multimorbidity: a longitudinal qualitative study of patient's prioritization of multiple conditions. *Chronic Illn* 2011;7:147–61.
94. Dufour SP, Graham S, Friesen J, *et al.* Physiotherapists supporting self-management through health coaching: a mixed methods program evaluation. *Physiother Theory Pract* 2015;31:29–38.
95. Stelfox M, Chaney B, Barry AE, *et al.* Web 2.0 chronic disease self-management for older adults: a systematic review. *J Med Internet Res* 2013;15:e35.
96. Junius-Walker U, Wrede J, Schlee T, *et al.* What is important, what needs treating? How GPs perceive older patients' multiple health problems: a mixed method research study. *BMC Res Notes* 2012;5:443.
97. Koroukian SM, Warner DF, Owusu C, *et al.* Multimorbidity redefined: prospective health outcomes and the cumulative effect of co-occurring conditions. *Prev Chronic Dis* 2015;12:E55.
98. Luijckx H, Lucassen P, van Weel C, *et al.* How GPs value guidelines applied to patients with multimorbidity: a qualitative study. *BMJ Open* 2015;5:e007905.
99. Wrede J, Voigt I, Bleidorn J, *et al.* Complex health care decisions with older patients in general practice: patient-centeredness and prioritization in consultations following a geriatric assessment. *Patient Educ Couns* 2013;90:54–60.
100. Schäfer I, Kaduszkiewicz H, Wagner HO, *et al.* Reducing complexity: a visualisation of multimorbidity by combining disease clusters and triads. *BMC Public Health* 2014;14:1285.
101. Katon W, Unützer J, Fan MY, *et al.* Cost-effectiveness and net benefit of enhanced treatment of depression for older adults with diabetes and depression. *Diabetes Care* 2006;29:265–70.
102. Sinnige J, Korevaar JC, Westert GP, *et al.* Multimorbidity patterns in a primary care population aged 55 years and over. *Fam Pract* 2015;32:505–13.
103. Morgan MA, Coates MJ, Dunbar JA, *et al.* The TrueBlue model of collaborative care using practice nurses as case managers for depression alongside diabetes or heart disease: a randomised trial. *BMJ Open* 2013;3:e002171.

104. Lin EH, Katon W, Von Korff M, *et al.* Effect of improving depression care on pain and functional outcomes among older adults with arthritis: a randomized controlled trial. *JAMA* 2003;290:2428–9.
105. Bayliss EA. Simplifying care for complex patients. *Ann Fam Med* 2012;10:3–5.
106. Foguet-Boreu Q, Violán C, Rodríguez-Blanco T, *et al.* Multimorbidity patterns in elderly primary health care patients in a south mediterranean European region: a cluster analysis. *PLoS One* 2015;10:e0141155.
107. White KM, Terry DJ, Troup C, *et al.* An extended theory of planned behavior intervention for older adults with type 2 diabetes and cardiovascular disease. *J Aging Phys Act* 2012;20:281–99.
108. Bond CS, Worswick L. Self management and telehealth: lessons learnt from the evaluation of a dorset telehealth program. *Patient* 2015;8:311–6.
109. Bleich SN, Sherrod C, Chiang A, *et al.* Systematic review of programs treating high-need and high-cost people with multiple chronic diseases or disabilities in the United States, 2008–2014. *Prev Chronic Dis* 2015;12:E197.
110. Lemmens KM, Nieboer AP, Huijsman R. A systematic review of integrated use of disease-management interventions in asthma and COPD. *Respir Med* 2009;103:670–91.
111. Foret Giddens J, Tanner E, Frey K, *et al.* Expanding the gerontological nursing role in Guided Care. *Geriatr Nurs* 2009;30:358–64.
112. Palmer C, Bycroft J, Healey K, *et al.* Can formal collaborative methodologies improve quality in primary health care in New Zealand? Insights from the EQUIPPED Auckland Collaborative. *J Prim Health Care* 2012;4:328–36.
113. Martín-Lesende I, Orruño E, Bilbao A, *et al.* Impact of telemonitoring home care patients with heart failure or chronic lung disease from primary care on healthcare resource use (the TELBIL study randomised controlled trial). *BMC Health Serv Res* 2013;13:118.
114. Franek J. Self-management support interventions for persons with chronic disease: an evidence-based analysis. *Ont Health Technol Assess Ser* 2013;13:1–60.
115. Maly RC, Leake B, Frank JC, *et al.* Implementation of consultative geriatric recommendations: the role of patient-primary care physician concordance. *J Am Geriatr Soc* 2002;50:1372–80.
116. Jaglal SB, Guilcher SJ, Hawker G, *et al.* Impact of a chronic disease self-management program on health care utilization in rural communities: a retrospective cohort study using linked administrative data. *BMC Health Serv Res* 2014;14:198.
117. Kamerow D. How can we treat multiple chronic conditions? *BMJ* 2012;344:e1487.
118. Laiterapong N, Huang ES, Chin MH. Prioritization of care in adults with diabetes and comorbidity. *Ann N Y Acad Sci* 2011;1243:69–87.
119. Arvidsson E, André M, Borgquist L, *et al.* Priority setting in primary health care - dilemmas and opportunities: a focus group study. *BMC Fam Pract* 2010;11:71.
120. Fortin M, Haggerty J, Almirall J, *et al.* Lifestyle factors and multimorbidity: a cross sectional study. *BMC Public Health* 2014;14:686.
121. Violan C, Foguet-Boreu Q, Flores-Mateo G, *et al.* Prevalence, determinants and patterns of multimorbidity in primary care: a systematic review of observational studies. *PLoS One* 2014;9:e102149.
122. Légaré F, Stacey D, Pouliot S, *et al.* Interprofessionalism and shared decision-making in primary care: a stepwise approach towards a new model. *J Interprof Care* 2011;25:18–25.
123. Dowdy D, Bishai D, Chen AH. Setting clinical priorities: a framework for incorporating individual patient preferences. *Patient Educ Couns* 2013;90:141–3.
124. Junius-Walker U, Wrede J, Voigt I, *et al.* Impact of a priority-setting consultation on doctor-patient agreement after a geriatric assessment: cluster randomised controlled trial in German general practices. *Qual Prim Care* 2012;20:321–34.
125. Arvidsson E, André M, Borgquist L, *et al.* Setting priorities in primary health care-on whose conditions? A questionnaire study. *BMC Fam Pract* 2012;13:114.
126. EPOC. EPOC (Effective Practice and Organization of Care) Taxonomy. Cochrane Collaboration. <http://epoc.cochrane.org/epoc-taxonomy>. Published 2015 (Accessed 8th May 2017).
127. Brown S, Lhussier M, Dalkin SM, *et al.* Care planning: what works, for whom, and in what circumstances? a rapid realist review. *Qual Health Res* 2018;28:2250–66.
128. Rosbach M, Andersen JS. Patient-experienced burden of treatment in patients with multimorbidity - A systematic review of qualitative data. *PLoS One* 2017;12:e0179916.
129. Kinsella S. *Older people and social isolation: a review of the evidence*. In. Birkenhead, England: Wirral Council Business, 2014.
130. StatsCan. Seniors' income from 1976 to 2014: Four decades, two stories. Statistics Canada. 2018 <http://www.statcan.gc.ca/pub/11-630-x/11-630-x2016008-eng.htm> (Accessed 4 May 2018).