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Quality of care assessment for people with multimorbidity.

Running headline

Assessing quality of care in multimorbidity

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Abstract

Multimorbidity, the simultaneous presence of multiple health conditions in an individual, is an increasingly common phenomenon globally. The systematic assessment of the quality of care delivered to people with multimorbidity will be key to informing the organisation of services for meeting their complex needs. Yet, current assessments tend to focus on single conditions and do not capture the complex processes that are required for providing care for people with multimorbidity. We conducted a scoping review on quality of care and multimorbidity in selected databases in June 2018 and identified 87 documents as eligible for review, predominantly original research and reviews from North America, and Europe, and Australasia and mostly frequently related to primary care settings. We synthesized data

qualitatively in terms of perceived challenges, evidence and proposed metrics. Findings reveal that the association between quality of care and multimorbidity is complex and depends on the conditions involved (quality appears to be higher for those with concordant conditions, and lower in the presence of discordant conditions) and the approach used for measuring quality (quality appears to be higher in people with multimorbidity when measured using condition/drug specific process or intermediate outcome indicators, and worse when using patient-centred reports of experiences of care). People with discordant multimorbidity may be disadvantaged by current approaches to quality assessment, particularly when they are linked to financial incentives. A better understanding of models of care that best meet the needs of this group is needed for developing appropriate quality assessment frameworks. Capturing patient preferences and values and incorporate patients' voices in the form of patient reported experiences and outcomes of care will be critical towards the achievement of high performing health systems that are responsive to the needs of people with multimorbidity.

Introduction

Chronic conditions contribute to a large proportion of the morbidity burden and pose a major challenge to health systems worldwide [1]. Response to chronic conditions is frequently complicated by multimorbidity, the simultaneous presence of multiple health conditions in an individual[2-5]. Multimorbidity challenges usual care delivery, which is frequently structured around pathways of care for single diseases[6-10]. Key principles have been proposed for the design of high performing health systems that meet the complex needs of people with multimorbidity, ranging from patient and caregiver engagement, to information systems, alignment of funding and incentives[11, 12]. Sustainable models of integrated care for multimorbidity currently being explored[13]. However, the evidence for how to effectively

improve health outcomes for people with multimorbidity remains patchy[10, 14, 15], as confirmed by an updated systematic review[16]. A recent randomized evaluation of a complex multidimensional intervention simultaneously targeting medicines management, mental health and patient centredness has further highlighted the continued challenge of demonstrating evidence of effect in this complex population [17].

Efforts to improve the outcomes of care for people with multimorbidity can be supported by the rigorous monitoring and evaluation of service delivery as part of a health system performance framework to inform evidence based decision making[18-21]. There has been growing interest in the systematic evaluation of the quality of health care (the degree to which health services for individuals and populations increase the likelihood of desired outcomes and are consistent with current professional knowledge) [19, 22-25]. This has included considerable work into the development and use of quality indicators for a range of prevalent conditions, such as ischaemic disease, stroke, COPD, diabetes and cancer, with some countries such as the United Kingdom or the USA linking performance based on these indicators to financial and non-financial incentives in an effort to improve the quality of care[19, 26, 27].

It has become increasingly clear, however, that a continued focus on the quality of care for single conditions fails to capture the complex processes required for providing care across conditions, nor does it provide the right stimulus to improve those service delivery components that are core to providing high quality care for people with multimorbidity, such as coordination and integration of care[6, 9, 28].

Overall there remains a need to systematically bring together the existing evidence base on efforts to assess the quality of care delivered to people with multimorbidity to help inform the development of an assessment framework that can then inform decision-making on the organisation and delivery of care that better meets the complex needs of people with multimorbidity. This paper seeks to contribute to this process by means of a scoping review that (i) explores how this issue has been framed in the literature, (ii) examines the empirical evidence of the association between quality of care and multimorbidity, and (iii) assesses metrics and frameworks that have been proposed for the evaluation of the quality of care delivered to people with multimorbidity.

Methods

We conducted a scoping review of the literature on multimorbidity and health care performance assessment focussing on quality of health care processes and outcomes. We selected this approach as an established method for clarifying conceptual boundaries and mapping out research areas that have not yet been extensively reviewed, and that are of complex and heterogeneous nature[29, 30].

We searched the following databases: OVID including MEDLINE, EMBASE, and Health Management Information Consortium (which includes the English Department of Health's Library and Information Services (DH-Data) and the King's Fund Information and Library Service), PubMed and the bibliographic database on multimorbidity maintained at the Health Services & Policy Research Group at the University of Exeter, which is updated weekly from ISI Web of Science and Google Scholar alerts for documents using the term "multimorbidity". We developed bespoke search strategies for each database using Boolean operators to link two main blocks: multimorbidity and health care performance. We used the

overarching term of 'health care performance' rather than the more narrow notion of 'quality of care processes and outcomes' to ensure the searches capture the wide range of work that may be of relevance to this study. This is based on our previous experience of conducting reviews of quality of care indicators that found that terms 'quality' and 'performance' are often used interchangeably, although the latter is typically understood as a broader, multidimensional concept that, in addition to quality, also includes dimensions of equity and efficiency[31]. While we recognize these important conceptual differences, in this paper, we will use the terms interchangeably also, reflecting the varying ways authors of papers included in this review have used these terms.

The search was implemented on 15th June 2018. We did not impose any restrictions on publication date, journal, type of publication or language. All citations were imported into the bibliographic manager EndNote. Duplicate citations were firstly removed automatically and subsequently through a manual process when needed.

A three-stage screening process was used to assess the relevance of studies identified in the search. Studies were eligible for inclusion if they made any reference to the assessment of health care quality for people with multimorbidity, with a specific focus on processes and outcomes of care. For the first level of screening, only the titles of citations were reviewed with a sensitive approach in which only documents whose scope was clearly outside the scope of this review were excluded. Title screening was piloted by three authors (JMV, JG, EJ) with 50 randomly selected titles in order to ensure consistent application of the eligibility criterion and then was subsequently applied independently by two reviewers (JG and EJ). In cases of disagreement the document was included in the next stage. The second level involved abstract review of documents deemed potentially eligible in the previous step using

the same inclusive and sensitive approach. The process was replicated for abstracts (pilot with 20 abstracts). In the third step, full texts of the documents deemed potentially eligible were screened (pilot with 5 papers). Disagreement was resolved at this stage by consensus. The characteristics of each full-text article were extracted by two reviewers (JG, EJ) using a standardized template. Based on a predefined framework, a narrative synthesis of the information contained in the included documents was conducted initially by two authors (JG, JMV) for comment and review by all authors. The proposed framework included: problem framing (justification of a focus on multimorbidity in the evaluation of health care quality); evidence (empirical data for the association between multimorbidity and the quality of process and outcomes of care); and measurement (metrics and frameworks that have been proposed for the evaluation of performance in the presence of multimorbidity). Formal assessment of the quality of includes studies was deemed inappropriate given the scope of the review and the broad range of types of articles retrieved.

Results

Search results

The search retrieved 435 documents after removal of duplicates (Fig. 1), and after eligibility screening a total of 87 documents were finally included[7-9, 11, 13, 16, 28, 32-111] (Appendix).

The literature reviewed included a wide range of documents, including original studies using qualitative and quantitative research methods, systematic reviews, policy briefs, editorials and commentaries, reports, and other (Table 1). The majority of documents originated in the US, Canada, selected European countries (UK, Netherlands, Ireland), New Zealand and Australia and were published in the last 5 years (Appendix).

Framing of the problem and perceived challenges

The literature reviewed justifies the need to focus on the evaluation of quality of care delivered to people with multimorbidity on grounds of the large numbers of those affected, and the impact of multimorbidity on health care processes and outcomes[104]. Concerns about the rising prevalence of multimorbidity are largely attributed to an increased prevalence of individual chronic conditions and to the association of multimorbidity with increasing age[38].

People with multimorbidity face a higher risk of complications of medical care, including pharmacological interactions and adverse drug events, avoidable admissions, and misalignment of multiple care plans proposed by different health professionals. These are perceived to be the attributable to higher service utilization in this population group (both more frequent and more varied utilization across multiple settings, and polypharmacy) as well as the intrinsic complexity of their clinical management[38, 40, 45, 67, 81]. High levels of service utilization are generally seen as the key determinant of increased health care costs, poor patient satisfaction and, potentially, also a contributor to adverse health outcomes, which include poor quality of life, reduced ability to work and employability, and increased disability and mortality [85, 87, 91].

There is consensus in the reviewed literature that the main challenge posed by multimorbidity for achieving high health care performance is the current organization of health care following a "disease oriented" model. This has broad implications, ranging from care financing and reimbursement to the degree of applicability of current clinical practice guidelines to this patient group[90]. Disease orientated care results in fragmentation and lack of coordination and continuity of care, making people with multimorbidity particularly vulnerable during transitions of care[64]. The literature supports the key role played by

primary care's patient focussed approach in contributing to both coordination and continuity of care[33, 52]. Lack of robust evidence on the most appropriate care for people with different multimorbidity profiles is recognized as a challenge for the provision of efficient and effective care[44]. The usually limited involvement of individuals in decision-making is perceived as a significant challenge for people with multimorbidity, as continued uncertainty about best management approaches makes effective patient engagement crucial[8].

The association of multimorbidity and quality of care: empirical evidence

Ricci-Cabello and colleagues have highlighted the complex association between quality of care and multimorbidity in their recent review, which found that the direction of the association seemed to depend on the constructs used for multimorbidity and quality assessment and their operationalization[89]. The quality of care appeared to be higher when quality was measured using condition/drug specific process or intermediate outcome indicators, and worse when quality was measured using patient-centred reports of experiences of care[89]. Of note, studies that explored the related construct of comorbidity (which considers the presence of conditions in relation to an index disease) found that care quality may be higher for those with concordant conditions (e.g., those sharing a common pathophysiological pathway and therefore more likely to benefit from the same clinical management, such as hypertension, ischaemic heart disease and diabetes), and lower in the presence of discordant conditions (those not sharing a common pathophysiological pathway, such as COPD and diabetes)[89, 111].

Panagioti et al. focussed specifically on safety in people with multimorbidity, finding that patient safety events (and their type) varied by the nature of multimorbidity[86]. Thus people with physical and mental health conditions were found to be at a higher risk of safety incidents than those with multimorbidity that did not involve mental health. Multimorbidity was also associated with increased risk of incidents that resulted in adverse outcomes[86].

Quality metrics and assessment frameworks for care for people with multimorbidity

Approaches to the evaluation of quality of care for people with multimorbidity in the reviewed literature frequently relies on aggregating disease specific indicators for the quality of processes and outcomes of care[63], which are typically derived from single disease oriented guidelines[36]. This additive model that considers quality of care for multimorbidity as the sum of estimates of quality of care for each individual condition is viewed critically[45], given the lack of robust empirical evidence supporting the validity of this approach[7]. Disease oriented guidelines may have limited applicability to people with multimorbidity[91], given their reliance on clinical trials which typically exclude medically complex patients or people undergoing multiple medical interventions. However, such patients are most commonly seen in clinical practice[90]. The additive approach does not account either for the potential of interactions between different treatments, between treatments and diseases (with the first complicating the prognosis and management of the latter) and between diseases, with potentially harmful consequences[69]. The additive approach also means that quality of care for some diseases may be given priority when there is wide variation in the number of indicators available for each condition[92].

The reviewed literature supports the need for the development of performance measures that: are specific for multimorbidity[54, 85] or non-specific but robust in the presence of multimorbidity[7,9]; rely on data from the electronic health record[40]; and include outcomes and processes of care, where there is evidence that the latter lead to improved outcomes[57]. The literature identifies a number of domains, and related measures, that broadly focus on areas reflecting the deficiencies in the provision of health care for people with multimorbidity that we have described above, and the outcomes of interventions targeting multimorbidity[16] (Box 1). However, much of the literature focuses on individual domains rather than bringing them together as part of a comprehensive assessment framework.

Experience in the development of multimorbidity specific performance measures is still limited[88]. The validity of such measures is contingent on the evidence supporting them and there remains paucity of research on best clinical approaches for people with multimorbidity [75]. However this is changing rapidly as an increasing body of research is being developed to address this gap[16].

A number of initiatives for the development of comprehensive frameworks for performance assessment for people with multimorbidity are identified in the literature. The Organisation for Economic Co-operation and Development (OECD) is developing survey based patient-reported indicators for capturing the experience and outcomes of care for patients with one or more chronic conditions[83]. Two core principles for the development of these indicators are patient involvement and the enablement of providers to use information for quality improvement and shared decision making. In parallel, the International Consortium for Health Outcomes Measurement, an independent consortium which the explicit goal of improving health system performance through standardized measurement, reporting and use

of patient outcomes, is developing a core set of outcomes for overall adult health with the explicit goal of ensuring relevance to people with multimorbidity [112, 113]. Although these two initiatives were developed independently, they are increasingly being aligned to avoid duplications of efforts[113].

At national level, the Department of Health and Human Services (DHHS) of the US Federal Government has acknowledged that the promotion of best practices in caring for individuals with multimorbidity requires specific performance measures that consider the complex and dynamic nature of care for these patients[87]. A measurement framework to facilitate the development and refinement of such measures has been proposed in collaboration with the National Quality Forum (NQF). The framework is centred around patient and family goals and preferences for care in the context of multiple care sites and providers, the type of care they are receiving and considers the following priority domains for health care quality measurement, including 1) optimizing function, maintaining function, or preventing further decline in function; 2) seamless transitions between multiple providers and sites of care; 3) patient important outcomes (includes patient-reported outcomes and relevant disease-specific outcomes); 4) avoiding inappropriate, non-beneficial care, including at the end of life; 5) access to a usual source of care; transparency of cost (total cost); 6) shared accountability across patients, families, and providers; and 7) shared decision-making[54, 57].

Discussion

This review has identified a number of documented efforts to advance thinking, evidence and methods in the area of quality of care for people with multimorbidity. This emerging body of evidence and methods can be further developed towards a comprehensive assessment framework for an effective health system response to the rising burden of multimorbidity.

We used a scoping review to capture the complex and heterogenous body of evidence around multimorbidity and health care quality. We sought to be inclusive in the type and nature of documents considered for review using very broad search terms. Clearly any such approach may still miss relevant literature. More importantly perhaps, we will have not captured ongoing work on care quality and models for people with multimorbidity, which remains an emergent field, in particular ongoing work on indicator development. We recognize this limitation arguing that it would have required a different approach to the review and which was not feasible within the scope of this study. We believe, however, and within these limitations, that the retrieved literature, gives a broad perspective of the current state of the art of advances in this area.

Our review has identified a number of important lessons around the systematic assessment of the quality of processes and outcomes of care for people with multimorbidity.

First, although there is evidence that multimorbidity may be associated with higher performance as measured by disease specific indicators, current approaches to performance assessment may disadvantage people with multimorbidity, particularly for patients with discordant conditions. Available condition specific indicators do not provide the right incentives for managing patients with multimorbidity and may act as a barrier for providing best care. Adjusting quality of care for multimorbidity (risk adjustment) or even incentivizing the delivery of care for people with multimorbidity offer only partial solutions as they would not need to address the core problem of the validity of the measures in this group of patients. Appropriate quality measures for multimorbidity are needed, and the frameworks reviewed in this paper are steps in this direction, while still very much in need for further development and support by evidence. Research on the burden of discordant conditions is needed for targeting those patients that may benefit most from this expanded approach.

Second, measures of quality of care need to be consistent with the models of care, their processes and their relevant outcomes. Epidemiological transitions across the globe made it necessary to adapt models of care essentially oriented to an acute disease model (linear approach focussing on a single etiological agent and the delivery of a single treatment) to effectively respond to chronic conditions (iterative approach dealing with multiple etiological agents and multiple management options). A similar transition is needed from a single disease model to a multimorbidity model. Such a model (and the assessment of its performance) has to account for the need to integrate care across conditions and providers and recognize the importance of patient centred care with explicit goal setting and prioritization[7, 12, 93, 110, 114-116] (Figure 2).

Third, the assessment of the quality of primary care should be at the core of evaluations of the care that people with multimorbidity receive. Transitions between providers and between episodes of care are critical to the needs of people with multimorbidity, requiring systematic coordination, continuity and comprehensiveness. Together with first contact care and person focus, these are also core functions of primary care[22, 118]. This well-established person focussed approach to health care delivery can be considered the core model of care on which to base further developments oriented to improving care for people with multimorbidity[12, 22, 118], as the primary care focus of both the OECD PaRIS and ICHOM initiatives demonstrate.

Fourth, person centred care should be a guiding principle for the development of assessment frameworks. People centredness, a core value of health systems, acknowldeges that individual service users should be the key stakeholders[120]. Their values, goals and priorities should shape care delivery and individual care plans, and this should be reflected accordingly in quality indicators. It has been proposed that making care more person centred

may also counter the care fragmentation, which is particularly detrimental to care of patients with multimorbidity, while increasing patient satisfaction[91].

Considering the evidence reviewed here, we identify two priority areas for further research and development. First, there is an urgent need to establish how to enable the routine collection of patient evaluations of health and health care using patient reported experience and outcome measures (PREMS and PROMs) and to incorporate these into comprehensive assessment frameworks[21, 107, 122-125]. Second, there is a need to advance approaches for the measurement of the role of service users (and their carers) as active partners in service delivery. This is notoriously difficult to capture in current information systems and developing the methods for best documenting and evaluating performance on core aspects such as explicit goal setting and prioritization should be a research priority[117, 126].

Conclusion

Single disease approaches to the measurement of quality of care for people with multimorbidity do not capture the complexity of the processes involved in meeting the complex needs of this population. This scoping review has identified important avenues for the further development of approaches for the systematic assessment of the quality of care for people with multimorbidity, but also highlighted the need for a critical shift in our understanding of the underlying models of care that can best meet the needs of this group for developing the evidence base. Assessment frameworks that capture patient preferences and values and incorporate patients' voices in the form of patient reported experiences and outcomes of care will be critical for making progress towards the achievement of high performing health systems.

Authors' contributions

JMV is the grantor. JMV designed the concept of the paper, which was agreed with CB, EN, MaR, MiR, and ASS. EJ, JG, and JMV had full access to all of the data in the study, implemented the search strategy, applied eligibility criteria, and extracted the information. JG and JMV conducted the analysis. ASS, CB, EN, JMV, MaR, and MiR contributed to the Session "Multimorbidity and Health Policy" of the International Symposium "Multimorbidity research at the cross-roads: developing the evidence for clinical practice and health policy" that took place on 21/05/2018 at the Nobel Forum, Karolinska Institutet, Stockholm, Sweden (for programme, presentations and lessons learned, see http://www.multimorbidity2018-stockholm.se and https://wol-prod-cdn.literatumonline.com/pb-assets/assets/13652796/Conference%20report%20Multimorbidity.pdf) and to a subsequent workshop where core aspects relevant to the development of the study were discussed. JMV drafted the first version of the manuscript, and all the authors (ASS, CB, EN, EJ, JG, JMV, MaR, and MiR) revised subsequent drafts critically for important intellectual content, and approved the final draft for publication.

Conflict of interest statement

JMV has contributed as an advisor to the development of the OECD PARIS initiative. JMV is the chair of the ICHOM panel for Overall Adult Health core set.

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References

1. WHO, *World health statistics 2018: monitoring health for the SDGs, sustainable development goals.* 2018, World Health Organization: Geneva.
2. Valderas, J.M., et al., *Defining comorbidity: implications for understanding health and health services.* Ann Fam Med, 2009. **7**(4): p. 357-63.
3. Violan, C., et al., *Burden of multimorbidity, socioeconomic status and use of health services across stages of life in urban areas: a cross-sectional study.* BMC Public Health, 2014. **14**: p. 530.
4. Calderon-Larranaga, A., et al., *Multimorbidity and functional impairment: bidirectional interplay, synergistic effects and common pathways.* J Intern Med, 2018.
5. Mounce, L.T.A., et al., *Predicting Incident Multimorbidity.* Ann Fam Med, 2018. **16**(4): p. 322-329.
6. Boyd, C., et al., *Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: implications for pay for performance.* JAMA, 2005. **294**: p. 716 - 24.
7. Tinetti, M.E., T.R. Fried, and C.M. Boyd, *Designing health care for the most common chronic condition--multimorbidity.* Jama, 2012. **307**(23): p. 2493-4.
8. Boyd, C.M. and M. Fortin, *Future of multimorbidity research: how should understanding of multimorbidity inform health system design?* Public Health Reviews, 2010. **32**(2): p. 451.
9. Valderas, J.M., *Multimorbidity, not a health condition or complexity by another name.* Eur J Gen Pract, 2015. **21**(4): p. 213-4.
10. Muth, C., et al., *Evidence supporting the best clinical management of patients with multimorbidity and polypharmacy: a systematic guideline review and expert consensus.* J Intern Med, 2018.
11. Mossialos, E.A.O., R.; Roland, M.; Abrams, M.; Amelung, V.; Balicer, R. D.; Battersby, M.; Anderson, G.; Bojestig, M.; Busse, R.; Durand-Zaleski, I.; Ikegami, N.; Meyer, G.; Pearson, M.; Rijken, M.; Sinha, S., *Designing a High-Performing Health Care System for Patients with Complex Needs. Ten Recommendations for Policymakers*. 2017, The Commonwealth Fund International Experts Working Group on Patients with Complex Needs.
12. Mai Stafford, A.S., Ruth Thorlby, Rebecca Fisher, Catherine Turton, Sarah Deeny., *Briefing: Understanding the health care needs of people with multiple health conditions*. 2018, The Health Foundation: London.
13. Leijten, F.R.M., et al., *The SELFIE framework for integrated care for multi-morbidity: Development and description.* Health Policy, 2018. **122**(1): p. 12-22.
14. WHO, *HIGH-LEVEL REGIONAL MEETING Health Systems Respond to NCDs: Experience in the European Region Sitges, Spain, 16–18 April 2018 Outcome statement*. 2018, World Health Organization.
15. Boyd, C.M. and D.M. Kent, *Evidence-based medicine and the hard problem of multimorbidity.* J Gen Intern Med, 2014. **29**(4): p. 552-3.
16. Smith, S.M., et al., *Interventions for improving outcomes in patients with multimorbidity in primary care and community settings.* Cochrane Database Syst Rev, 2016. **3**: p. Cd006560.
17. Salisbury, C., et al., *Management of multimorbidity using a patient-centred care model: a pragmatic cluster-randomised trial of the 3D approach.* Lancet, 2018. **392**(10141): p. 41-50.

18. WHO, *Health system performance assessment: a tool for health governance in the 21st century*. 2012, World Health Organization.
19. Smith PC, M.E., Leatherman S, Papanicolas I, ed., *Performance measurement for health system improvement: experiences, challenges and prospects.* . 2009: Cambridge University Press.
20. Smith, P., *Health System Performance Assessment*. 2014.
21. Greenhalgh, J., et al., *How do aggregated patient-reported outcome measures data stimulate health care improvement? A realist synthesis.* J Health Serv Res Policy, 2018. **23**(1): p. 57-65.
22. WHO, *A vision for primary health care in the 21st Century - Towards universal health coverage and the Sustainable Development Goals.*, in *Technical Series on Primary Health Care*. 2018, World Health Organization: Geneva.
23. WHO, *Primary health care: transforming vision into action. Operational Framework. Draft for consultation.*, in *Technical Series on Primary Health Care*. 2018, World Health Organization:: Geneva.
24. Academy, A., *A model for measuring quality care*, in *Online library of Quality, Service Improvement and Redesign tools*, N. Improvement, Editor. 2018.
25. Lohr, K.N., *Medicare: a strategy for quality assurance*. Vol. 1. 1990: National Academies Press.
26. Petersen, L.A., et al., *Does pay-for-performance improve the quality of health care?* Ann Intern Med, 2006. **145**(4): p. 265-72.
27. Roland, M. and F. Olesen, *Can pay for performance improve the quality of primary care?* BMJ, 2016. **354**: p. i4058.
28. Ritchie, C., *Health care quality and multimorbidity: The jury is still out.* Medical Care, 2007. **45**(6): p. 477-479.
29. Institute, T.J.B., *Joanna Briggs Institute Reviewers' Manual*, T.J.B. Institute, Editor. 2015, The University of Adelaide.
30. Pham, M.T., et al., *A scoping review of scoping reviews: advancing the approach and enhancing the consistency.* Res Synth Methods, 2014. **5**(4): p. 371-85.
31. Nolte, E., *International benchmarking of healthcare quality. A review of the literature*, in *Technical Reports*. 2010, RAND Corporation & London School of Hygiene & Tropical Medicine: Santa Monica/London.
32. Ajmera, M., et al., *Multimorbidity, Mental Illness, and Quality of Care: Preventable Hospitalizations among Medicare Beneficiaries.* Int J Family Med, 2012. **2012**: p. 823294.
33. Altiner, A., et al., *Activating GENeral practitioners dialogue with patients on their Agenda (MultiCare AGENDA) study protocol for a cluster randomized controlled trial.* BMC Fam Pract, 2012. **13**: p. 118.
34. Barbabella, F.M., M. G.; Quattrini, S.; Papa, R.; Lamura, G., *How can eHealth improve care for people with multimorbidity in Europe?* 2017, ICARE4EU: Utrecht.
35. Bayliss, E.A., et al., *Using Electronic Health Record Data to Measure Care Quality for Individuals with Multiple Chronic Medical Conditions.* Journal of the American Geriatrics Society, 2016. **64**(9): p. 1839-1844.
36. Boyd, C.M., et al., *Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: implications for pay for performance.* JAMA, 2005. **294**(6): p. 716-24.
37. Boyd, C.M., et al., *From bedside to bench: Summary from the American Geriatrics Society/National Institute on Aging Research Conference on Comorbidity and Multiple Morbidity in Older Adults.* Aging Clinical and Experimental Research, 2008. **20**(3): p. 181-188.

38. Brilleman, S.L. and C. Salisbury, *Comparing measures of multimorbidity to predict outcomes in primary care: a cross sectional study.* Fam Pract, 2013. **30**(2): p. 172-8.
39. Burgers, J.S., et al., *Quality and coordination of care for patients with multiple conditions: Results from an international survey of patient experience.* Evaluation and the Health Professions, 2010. **33**(3): p. 343-364.
40. Burt, J., et al., *Developing a measure of polypharmacy appropriateness in primary care: systematic review and expert consensus study.* BMC Med, 2018. **16**(1): p. 91.
41. Busato, A., et al., *Improving the quality of morbidity indicators in electronic health records in Swiss primary care: A practical approach.* Swiss Medical Weekly, 2012. **142**(w13611).
42. Bynum, J.P.W., et al., *Outcomes in Older Adults with Multimorbidity Associated with Predominant Provider of Care Specialty.* Journal of the American Geriatrics Society, 2017. **65**(9): p. 1916-1923.
43. Chan, C.L., et al., *Using an integrated COC index and multilevel measurements to verify the care outcome of patients with multiple chronic conditions.* BMC health services research, 2012. **12**: p. 405.
44. Chandraratne, N.K., et al., *A comparison of policies and guidelines related to multimorbidity in the UK, Australia and Sri Lanka.* Aust J Gen Pract, 2018. **47**(1-2): p. 14-19.
45. Colombo, F., M. Garcia-Goni, and C. Schwierz, *Addressing multimorbidity to improve healthcare and economic sustainability.* J Comorb, 2016. **6**(1): p. 21-27.
46. Dantas, R.G., et al., *What are the sociodemographic and health determinants for older adults continue to participate in work?* Archives of Gerontology and Geriatrics, 2017. **71**: p. 136-141.
47. de Bruin, S.R., et al., *Comprehensive care programs for patients with multiple chronic conditions: A systematic literature review.* Health Policy, 2012. **107**(2-3): p. 108-145.
48. Djalali, S.F., A.; Tandjung, R.; Baltensperger, A.; Rosemann, T., *Swiss Quality and Outcomes Framework: Quality Indicators for Diabetes Management in Swiss Primary Care Based on Electronic Medical Records.* Gerontology, 2014. **60**(3): p. 263-273.
49. Drye, E.E., et al., *Defining Multiple Chronic Conditions for Quality Measurement.* Medical Care, 2018. **56**(2): p. 193-201.
50. DuGoff, E.H., et al., *Setting standards at the forefront of delivery system reform: aligning care coordination quality measures for multiple chronic conditions.* Journal for Healthcare Quality, 2013. **35**(5): p. 58-69.
51. Dy, S.M., et al., *Health-related quality of life and functional status quality indicators for older persons with multiple chronic conditions.* Journal of the American Geriatrics Society, 2013. **61**(12): p. 2120-2127.
52. Edwards, S.T. and B.E. Landon, *Seeking Value in Healthcare: The Importance of Generalists as Primary Care Physicians.* Journal of the American Geriatrics Society, 2017. **65**(9): p. 1900-1901.
53. Eton, D.T., et al., *Healthcare provider relational quality is associated with better self-management and less treatment burden in people with multiple chronic conditions.* Patient Preference and Adherence, 2017. **11**: p. 1635-1646.
54. NQF, *Multiple Chronic Conditions Measurement Framework*, N.Q. Forum, Editor. 2012: Washington DC.
55. Fung, C.H., et al., *The relationship between multimorbidity and patients' ratings of communication.* Journal of General Internal Medicine, 2008. **23**(6): p. 788-793.

56. Garvey, J., et al., *OPTIMAL, an occupational therapy led self-management support programme for people with multimorbidity in primary care: a randomized controlled trial.* BMC family practice, 2015. **16**: p. 59.
57. Giovannetti, E.R., et al., *Performance measurement for people with multiple chronic conditions: Conceptual model.* American Journal of Managed Care, 2013. **19**(10): p. e359-e366.
58. Gnaedinger, M., et al., *Chronic conditions and multimorbidity in a primary care population: a study in the Swiss Sentinel Surveillance Network (Sentinella).* International Journal of Public Health.
59. Hadgraft, N.T., et al., *Reducing occupational sitting: Workers' perspectives on participation in a multi-component intervention.* Int J Behav Nutr Phys Act, 2017. **14**(1): p. 73.
60. Haggerty, J.L., *Ordering the chaos for patients with multimorbidity.* BMJ (Online), 2012. **345 (7876)**(e5915).
61. Heale, R., et al., *Nurse practitioner's perceptions of the impact of the nurse practitioner-led clinic model on the quality of care of complex patients.* Prim Health Care Res Dev, 2018: p. 1-8.
62. Heisler, M., *Eliciting Personal Values of Patients with Multiple Chronic Conditions: Why and How.* Journal of General Internal Medicine, 2017. **32**(12): p. 1273-1274.
63. Higashi, T., et al., *Relationship between number of medical conditions and quality of care.* New England Journal of Medicine, 2007. **356**(24): p. 2496-2504.
64. Hijazi, H.H., et al., *Risk assessment of comorbidities on 30-day avoidable hospital readmissions among internal medicine patients.* J Eval Clin Pract, 2017. **23**(2): p. 391-401.
65. Holland, D.E., et al., *Exploring indicators of use of costly health services in community-dwelling adults with multiple chronic conditions.* Professional case management, 2015. **20**(1): p. 3-11; quiz 12-3.
66. Huntley, A.L., et al., *Measures of multimorbidity and morbidity burden for use in primary care and community settings: a systematic review and guide.* Annals of family medicine, 2012. **10**(2): p. 134-141.
67. Iezzoni, L.I., *Multiple chronic conditions and disabilities: Implications for health services research and data demands.* Health Services Research, 2010. **45**(5 PART 2): p. 1523-1540.
68. Ihle, A., et al., *Prospective and retrospective memory are differentially related to self-rated omission and commission errors in medication adherence in multimorbidity.* Appl Neuropsychol Adult, 2017. **24**(6): p. 505-511.
69. Kahn, L.S., et al., *Facilitating quality improvement in physician management of comorbid chronic disease in an urban minority practice.* Journal of the National Medical Association, 2007. **99**(4): p. 377-383.
70. Kontopantelis, E., et al., *Associations between exemption and survival outcomes in the UK's primary care pay-for-performance programme: A retrospective cohort study.* BMJ Quality and Safety, 2016. **25**(9): p. 657-670.
71. Krause, C.M., et al., *The impact of a multidisciplinary, integrated approach on improving the health and quality of care for individuals dealing with multiple chronic conditions.* American Journal of Orthopsychiatry, 2006. **76**(1): p. 109-114.
72. LeRoy, L., et al., *The agency for healthcare research and quality multiple chronic conditions research network: Overview of research contributions and future priorities.* Medical Care, 2014. **52**(3 SUPPL. 2): p. S15-S22.
73. Mair, F.S. and C.R. May, *Thinking about the burden of treatment: Should it be regarded as an indicator of the quality of care?* BMJ (Online), 2014. **349**(g6680).

74. Mangin, D., I. Heath, and M. Jamoulle, *Beyond diagnosis: Rising to the multimorbidity challenge.* BMJ (Online), 2012. **344 (7865)**(e3526).
75. Marengoni, A., *Guidelines for elderly patients with multimorbidity: How to cope with a dark night without fear.* Aging Clinical and Experimental Research, 2013. **25**(6): p. 703-705.
76. Mas, M.A., *Capsule Commentary on Bennett et al., Engaging Stakeholders to Inform Clinical Practice Guidelines that Address Multiple Chronic Conditions.* Journal of General Internal Medicine, 2017. **32**(8): p. 918.
77. Melchiorre, M.G., et al., *eHealth in integrated care programs for people with multimorbidity in Europe: Insights from the ICARE4EU project.* Health Policy, 2018. **122**(1): p. 53-63.
78. Min, L., et al., *Contrasting effects of geriatric versus general medical multimorbidity on quality of ambulatory care.* Journal of the American Geriatrics Society, 2014. **62**(9): p. 1714-1721.
79. Min, L.C., et al., *Multimorbidity is associated with better quality of care among vulnerable elders.* Medical Care, 2007. **45**(6): p. 480-488.
80. Moran, W.P., et al., *Chaos to complexity: leveling the playing field for measuring value in primary care.* Journal of Evaluation in Clinical Practice, 2017. **23**(2): p. 430-438.
81. Narayan, S.W. and P.S. Nishtala, *Development and validation of a Medicines Comorbidity Index for older people.* European Journal of Clinical Pharmacology, 2017. **73**(12): p. 1665-1672.
82. Ndukwe, K., E. Burns, and J. Johnson, *Multiple morbidity and functional status in older adults.* Journal of the American Geriatrics Society, 2017. **65 (Supplement 1)**: p. S248.
83. OECD, *Patient-Reported Indicators Survey (PaRIS)*. 2017.
84. Ozminkowski, R.J., et al., *Big Data, Little Data, and Care Coordination for Medicare Beneficiaries with Medigap Coverage.* Big data, 2015. **3**(2): p. 114-125.
85. Palmer, K., et al., *Multimorbidity care model: Recommendations from the consensus meeting of the Joint Action on Chronic Diseases and Promoting Healthy Ageing across the Life Cycle (JA-CHRODIS).* Health Policy, 2018. **122**(1): p. 4-11.
86. Panagioti, M., et al., *Multimorbidity and Patient Safety Incidents in Primary Care: A Systematic Review and Meta-Analysis.* PLoS One, 2015. **10**(8).
87. Parekh, A.K., et al., *Managing Multiple Chronic Conditions: A Strategic Framework for Improving Health Outcomes and Quality of Life*, in *Public Health Reports*. 2011.
88. Pillay, M., S. Dennis, and M.F. Harris, *Quality of care measures in multimorbidity.* Aust Fam Physician, 2014. **43**(3): p. 132-6.
89. Ricci-Cabello, I., et al., *Impact of multi-morbidity on quality of healthcare and its implications for health policy, research and clinical practice. A scoping review.* Eur J Gen Pract, 2015. **21**(3): p. 192-202.
90. Rijken, M., et al., *Chronic Disease Management Programmes: an adequate response to patients' needs?* Health Expect, 2014. **17**(5): p. 608-21.
91. Rijken, M., et al., *How to improve care for people with multimorbidity in Europe?* 2017, ICARE4EU.
92. Ruscitto, A., et al., *Accounting for multimorbidity in pay for performance: A modelling study using UK Quality and Outcomes Framework data.* British Journal of General Practice, 2016. **66**(649): p. e561-e567.
93. Salisbury, C., *Multimorbidity: Redesigning health care for people who use it.* The Lancet, 2012. **380**(9836): p. 7-9.

94. Sampalli, T., et al., *Proposed model of integrated care to improve health outcomes for individuals with multimorbidities.* Patient Preference and Adherence, 2012. **6**: p. 757-764.
95. Schiotz, M.L., et al., *Quality of care for people with multimorbidity - a case series.* BMC health services research, 2017. **17**(1): p. 745.
96. Shadmi, E., et al., *Morbidity and older persons' perceptions of the quality of their primary care.* Journal of the American Geriatrics Society, 2006. **54**(2): p. 330-334.
97. Snyder, L., et al., *Pay-for-performance principles that promote patient-centered care: an ethics manifesto.* Annals of Internal Medicine, 2007. **147**(11): p. 792-4.
98. Streit, S., et al., *Multimorbidity and quality of preventive care in Swiss University primary care cohorts.* PLoS ONE, 2014. **9 (4) (no pagination)**(e96142).
99. Tinetti, M.E. and S.A. Studenski, *Comparative effectiveness research and patients with multiple chronic conditions.* New England Journal of Medicine, 2011. **364**(26): p. 2478-2481.
100. Uhlig, K., et al., *A Framework for Crafting Clinical Practice Guidelines that are Relevant to the Care and Management of People with Multimorbidity.* Journal of General Internal Medicine, 2014. **29**(4): p. 670-9.
101. van der Heide, I., et al., *How to strengthen patientcentredness in caring for people with multimorbidity in Europe?* 2017, ICARE4EU.
102. Venkatesh, A., K. Goodrich, and P.H. Conway, *Opportunities for quality measurement to improve the value of care for patients with multiple chronic conditions.* Annals of Internal Medicine, 2014. **161**(Supplement 10): p. S76-S80.
103. Vetrano, D.L., et al., *An international perspective on chronic multimorbidity: approaching the elephant in the room.* The journals of gerontology. Series A, Biological sciences and medical sciences, 2017.
104. Vogeli, C., et al., *Multiple chronic conditions: Prevalence, health consequences, and implications for quality, care management, and costs.* Journal of General Internal Medicine, 2007. **22**(SUPPL. 3): p. 391-395.
105. Wallace, E., et al., *Comparison of count-based multimorbidity measures in predicting emergency admission and functional decline in older community-dwelling adults: a prospective cohort study.* BMJ open, 2016. **6**(9): p. e013089.
106. Wittenberg, R., *The challenge of measuring multi-morbidity and its costs.* Israel Journal of Health Policy Research, 2015. **4 (1) (no pagination)**(1).
107. Wodchis, W.P., *Performance Measurement for People with Multimorbidity and Complex Health Needs.* Health Quarterly, 2016. **19**(2).
108. Zulman, D.M., et al., *Quality of care for patients with multiple chronic conditions: The role of comorbidity interrelatedness.* Journal of General Internal Medicine, 2014. **29**(3): p. 529-537.
109. Leijten, F.R.M., et al., *Defining good health and care from the perspective of persons with multimorbidity: results from a qualitative study of focus groups in eight European countries.* BMJ Open, 2018. **8**(8): p. e021072.
110. Roland, M. and C. Paddison, *Better management of patients with multimorbidity.* BMJ, 2013. **346**: p. f2510.
111. Ricci-Cabello, I., et al., *Impact of the prevalence of concordant and discordant conditions on the quality of diabetes care in family practices in England.* The Annals of Family Medicine, 2015. **13**(6): p. 514-522.
112. Akpan, A., et al., *Standard set of health outcome measures for older persons.* BMC Geriatr, 2018. **18**(1): p. 36.
113. Berwick D, B.N., Cullen D, Deerberg-Wittram J, Degos L, Diverty B, Epstein A, Kieny MP, Kieny BI, Schneider E, Schreck S, Sheingold S, Wigzell O.,

Recommendations to OECD Ministers of Health from the High Level Reflection Group on the Future of Health Statistics. Strengthening the International comparison of health system performance through patient-reported indicators. 2017, OECD.
114. Dowrick, C., *Patient-centred care for multimorbidity: an end in itself?* The Lancet, 2018. **392**(10141): p. 4-5.
115. Muth, C., et al., *The Ariadne principles: how to handle multimorbidity in primary care consultations.* BMC medicine, 2014. **12**(1): p. 223.
116. Tinetti, M.E., A.D. Naik, and J.A. Dodson, *Moving from disease-centered to patient goals-directed care for patients with multiple chronic conditions: Patient value-based care.* JAMA Cardiology, 2016. **1**(1): p. 9-10.
117. Starfield, B., *Primary care: balancing health needs, services and technology,*. 1998, New York: Oxford University Press.
118. Roland, M. and E. Nolte, *The future shape of primary care.* Br J Gen Pract, 2014. **64**(619): p. 63-4.
119. Nolte, E., *Implementing person centred approaches.* BMJ, 2017. **358**: p. j4126.
120. Coulter, A., *Measuring what matters to patients.* BMJ, 2017. **356**: p. j816.
121. Black, N., *Patient reported outcome measures could help transform healthcare.* BMJ, 2013. **346**.
122. Valderas, J.M. and J. Alonso, *Patient reported outcome measures: a model-based classification system for research and clinical practice.* Qual Life Res, 2008. **17**.
123. Edelen, M.O., et al., *Patient-Reported Outcome-Based Performance Measures for Older Adults with Multiple Chronic Conditions.* Rand Health Q, 2018. **8**(2): p. 3.
124. Ricci-Cabello, I., et al., *Identifying primary care pathways from quality of care to outcomes and satisfaction using structural equation modeling.* Health services research, 2018. **53**(1): p. 430-449.
125. Calvert M, Kyte D, Price G, Valderas JM, Hjollund NH. Maximising the impact of patient reported outcome assessment for patients and society *BMJ* 2019; **364** :k5267
126. Porter I, E.P., Valderas JM., *Routine individualized PRO feedback for the management of patients with multimorbidity in primary care: a pilot study in General Practice in England.* Quality of Life Research, 2016. **25**: p. 1.

Table 1. Characteristics of included documents (n=87)

Characteristic	n (%)
Year	
2006-2010	14 (16)
2011-2015	38 (44)
2016-2018	35 (40)
Type of document	
Original research	38 (44)
Review	22 (25)
Policy brief	3 (3)
Other	24 (28)
Setting*	
Primary Care	44 (47)
Other setting	20 (21)
Non specific	30 (32)
Country*	
USA	38 (31)
UK	15 (12)
Canada	9 (7)
Australia	8 (7)
Germany	7 (6)
Other	46 (37)

**Categories exceed 100% as categories are not mutually exclusive. See Appendix for full details of included studies.*

Figure 1. PRISMA Flowchart of the study selection process

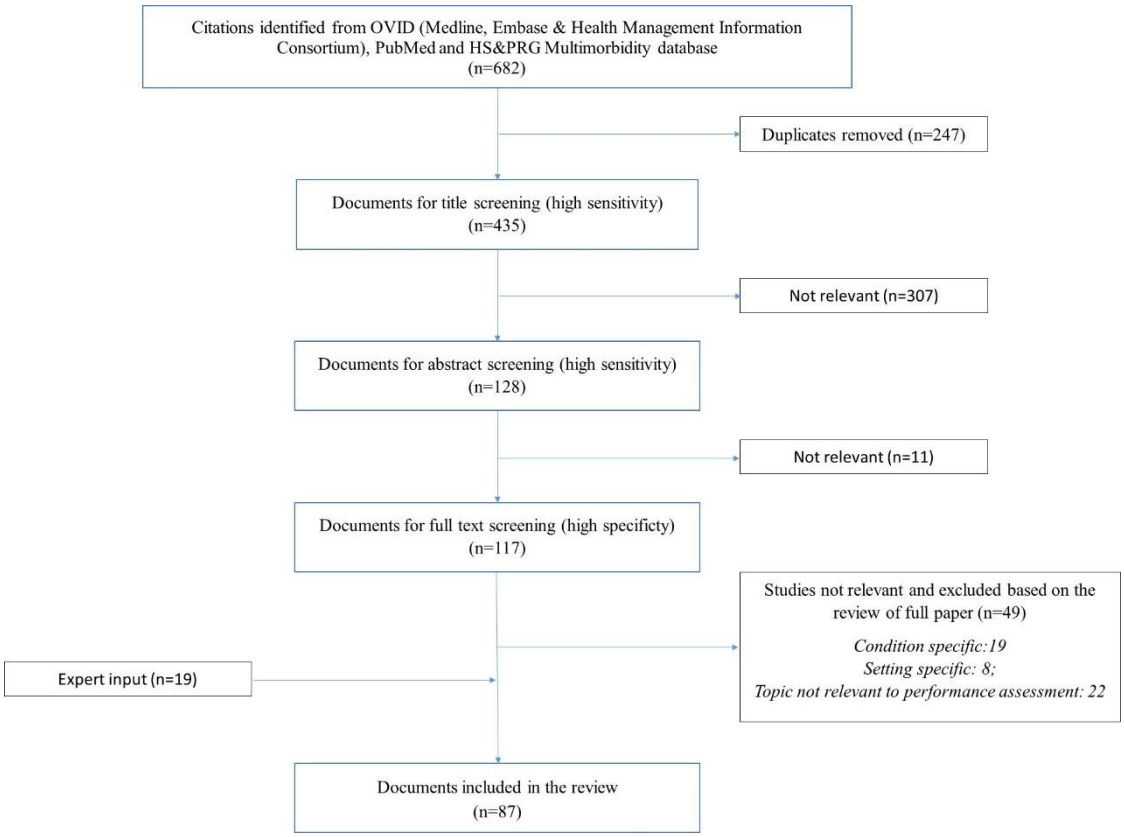
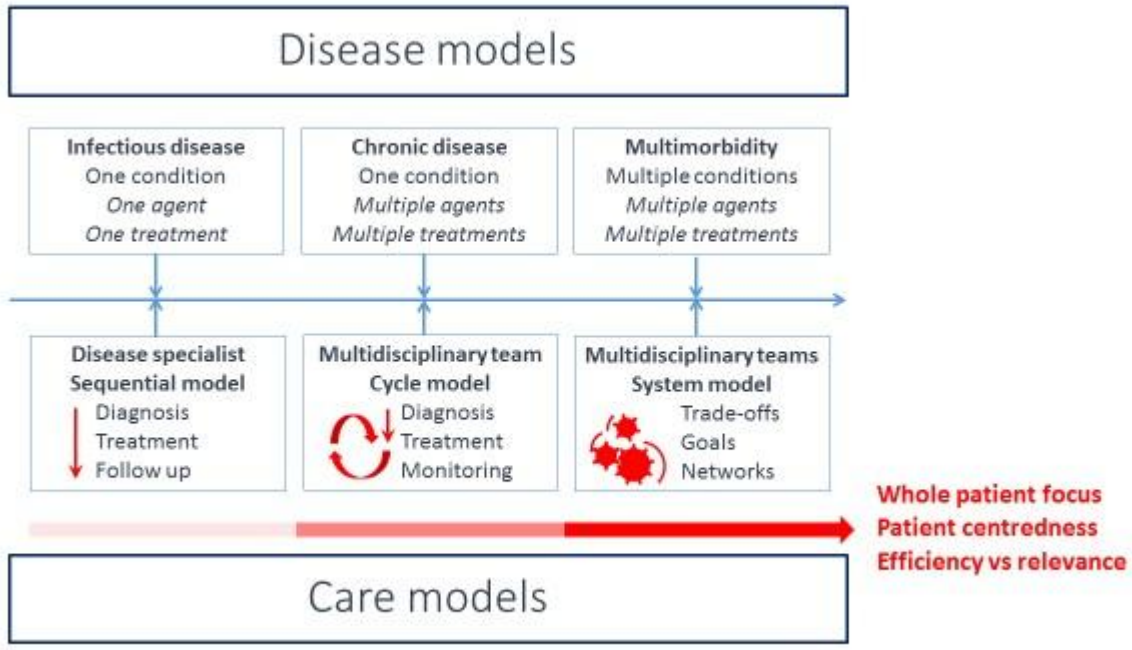


Figure 2. Models of care as informed by models of disease.



Box 1. Domains relevant to quality of care and performance assessment in people with multimorbidity.

Process of care

Continuity

Coordination

Comprehensiveness

Patient centredness

Preferences elicitation

Prioritisation

Individualized goal setting

Self-efficacy

Management of life style factors

Management of specific diseases

Medicines management

Use of health services

Experience of care and satisfaction

Experiences of care

Satisfaction with care

Outcomes of care

Patient reported outcomes (symptoms, functioning, health related quality of life)

Adverse events

Study number	Publication	Year	Country	Setting	Study design
1	Tinetti ME, Fried TR, Boyd CM. Designing health care for the most common chronic condition--multimorbidity. Jama. 2012;307(23):2493-4.	2012	USA	Not specific	View point
2	Boyd CM, Fortin M. Future of multimorbidity research: how should understanding of multimorbidity inform health system design? Public Health Reviews. 2010;32(2):451.	2010	Not specified	Not specific	Review
3	Valderas, J.M., Multimorbidity, not a health condition or complexity by another name. Eur J Gen Pract, 2015. 21(4): p. 213-4	2015	Not specified	Primary care	Editorial
4	Mossialos, E.A.O., R.; Roland, M.; Abrams, M.; Amelung, V.; Balicer, R. D.; Battersby, M.; Anderson, G.; Bojestig, M.; Busse, R.; Durand-Zaleski, I.; Ikegami, N.; Meyer, G.; Pearson, M.; Rijken, M.; Sinha, S., Designing a High-Performing Health Care System for Patients with Complex Needs. Ten Recommendations for Policymakers. 2017, The Commonwealth Fund International Experts Working Group on Patients with Complex Needs.	2017	Not specified	Not specific	International group Committee meeting
5	Leijten, F.R.M., et al., The SELFIE framework for integrated care for multi-morbidity: Development and description. Health Policy, 2018. 122(1): p. 12-22.	2018	Not specified	Not specific	scoping review
6	Smith, S.M., et al., Interventions for improving outcomes in patients with multimorbidity in primary care and community settings. Cochrane Database Syst Rev, 2016. 3: p. Cd006560.	2016	USA, UK, Canada	primary care and community settings	Systematic review
7	Ritchie, C., Health care quality and multimorbidity: The jury is still out. Medical Care, 2007. 45(6): p. 477-479.	2007	USA	Not applicable	Editorial
8	Ajmera, M., et al., Multimorbidity, Mental Illness, and Quality of Care: Preventable Hospitalizations among Medicare Beneficiaries. Int J Family Med, 2012. 2012: p. 823294.	2012	USA	community dwelling	Longitudinal survey
9	Altiner, A., et al., Activating GENeral practitioners dialogue with patients on their Agenda (MultiCare AGENDA) study protocol for a cluster randomized controlled trial. BMC Fam Pract, 2012. 13: p. 118.	2012	Germany	Primary care	Randomised controlled trial
10	Barbabella, F.M., M. G.; Quattrini, S.; Papa, R.; Lamura, G., How can eHealth improve care for people with multimorbidity in Europe? 2017, ICARE4EU: Utrecht.	2017	European region	Primary and secondary care	Policy brief

11	Bayliss, E.A., et al., Using Electronic Health Record Data to Measure Care Quality for Individuals with Multiple Chronic Medical Conditions. Journal of the American Geriatrics Society, 2016. 64(9): p. 1839-1844.	2016	Colorado	Primary and secondary care (geriatrics)	Qualitative study
12	Boyd, C.M., et al., Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: implications for pay for performance. JAMA, 2005. 294(6): p. 716-24.	2005	USA	Primary care	Literature review
13	Boyd, C.M., et al., From bedside to bench: Summary from the American Geriatrics Society/National Institute on Aging Research Conference on Comorbidity and Multiple Morbidity in Older Adults. Aging Clinical and Experimental Research, 2008. 20(3): p. 181-188.	2008	USA	Not specific	Conference report
14	Brilleman, S.L. and C. Salisbury, Comparing measures of multimorbidity to predict outcomes in primary care: a cross sectional study. Fam Pract, 2013. 30(2): p. 172-8.	2013	UK	Primary care	Cross sectional study
15	Burgers, J.S., et al., Quality and coordination of care for patients with multiple conditions: Results from an international survey of patient experience. Evaluation and the Health Professions, 2010. 33(3): p. 343-364.	2010	Australia, Canada, France, Germany, the Netherlands, New Zealand, United Kingdom, and United States	Not specific	Survey
16	Burt, J., et al., Developing a measure of polypharmacy appropriateness in primary care: systematic review and expert consensus study. BMC Med, 2018. 16(1): p. 91.	2018	Australia, Europe Canada, Germany, the Netherlands, United Kingdom, United States, Malaysia, Spain, and Belgium	Primary care	Systematic review and consensus survey
17	Busato, A., et al., Improving the quality of morbidity indicators in electronic health records in Swiss primary care: A practical approach. Swiss Medical Weekly, 2012. 142(w13611).	2012	Switzerland	Primary care	Quantitative analysis
18	Bynum, J.P.W., et al., Outcomes in Older Adults with Multimorbidity Associated with Predominant Provider of Care Specialty. Journal of the American Geriatrics Society, 2017. 65(9): p. 1916-1923.	2017	USA	Primary (family or internal medicine, geriatrics, nurse	Observational study

				practitioner) and secondary care (all specialities) Medicare fee-for-service	
19	Chan, C.L., et al., Using an integrated COC index and multilevel measurements to verify the care outcome of patients with multiple chronic conditions. BMC health services research, 2012. 12: p. 405.	2012	Taiwan	Secondary care (outpatients and inpatients)	Retrospective cohort study
20	Chandraratne, N.K., et al., A comparison of policies and guidelines related to multimorbidity in the UK, Australia and Sri Lanka. Aust J Gen Pract, 2018. 47(1-2): p. 14-19.	2018	UK, Australia, Sri Lanka	primary health care	Content analysis
21	Colombo, F., M. Garcia-Goni, and C. Schwierz, Addressing multimorbidity to improve healthcare and economic sustainability. J Comorb, 2016. 6(1): p. 21-27.	2016	European Union	Not specific	Review
22	Dantas, R.G., et al., What are the sociodemographic and health determinants for older adults continue to participate in work? Archives of Gerontology and Geriatrics, 2017. 71: p. 136-141.	2017	Brazil	Not specific	A cross-sectional study
23	de Bruin, S.R., et al., Comprehensive care programs for patients with multiple chronic conditions: A systematic literature review. Health Policy, 2012. 107(2-3): p. 108-145.	2012	USA, Canada, Australia, Norway, UK, Netherlands	Primary and secondary care	Systematic review
24	Djalali, S.F., A.; Tandjung, R.; Baltensperger, A.; Rosemann, T., Swiss Quality and Outcomes Framework: Quality Indicators for Diabetes Management in Swiss Primary Care Based on Electronic Medical Records. Gerontology, 2014. 60(3): p. 263-273.	2014	Switzerland	Primary care	Dataset secondary analysis
25	Drye, E.E., et al., Defining Multiple Chronic Conditions for Quality Measurement. Medical Care, 2018. 56(2): p. 193-201.	2018	USA	Not specific	Cohort study
26	DuGoff, E.H., et al., Setting standards at the forefront of delivery system reform: aligning care coordination quality measures for multiple chronic conditions. Journal for Healthcare Quality, 2013. 35(5): p. 58-69.	2013	USA	Primary and secondary care (primary and specialist community-based offices, hospitals, post-	Care coordination programme

				acute facilities, and pharmacies)	
27	Dy, S.M., et al., Health-related quality of life and functional status quality indicators for older persons with multiple chronic conditions. Journal of the American Geriatrics Society, 2013. 61(12): p. 2120-2127.	2013	USA	Ambulatory care (National Quality Measures Clearinghouse and National Quality Forum)	Review
28	Edwards, S.T. and B.E. Landon, Seeking Value in Healthcare: The Importance of Generalists as Primary Care Physicians. Journal of the American Geriatrics Society, 2017. 65(9): p. 1900-1901.	2017	USA	Primary care	Editorial
29	Eton, D.T., et al., Healthcare provider relational quality is associated with better self-management and less treatment burden in people with multiple chronic conditions. Patient Preference and Adherence, 2017. 11: p. 1635-1646.	2017	USA	Secondary care (multispecialty hospitals)	Cross sectional study
30	NQF, Multiple Chronic Conditions Measurement Framework, N.Q. Forum, Editor. 2012: Washington DC.	2012	USA	Not specific	Consensus development study
31	Fung, C.H., et al., The relationship between multimorbidity and patients' ratings of communication. Journal of General Internal Medicine, 2008. 23(6): p. 788-793.	2008	USA	Primary care	Cross-sectional study
32	Garvey, J., et al., OPTIMAL, an occupational therapy led self-management support programme for people with multimorbidity in primary care: a randomized controlled trial. BMC family practice, 2015. 16: p. 59.	2015	Ireland	Primary care (family practice and primary care settings)	Randomised controlled trial
33	Giovannetti, E.R., et al., Performance measurement for people with multiple chronic conditions: Conceptual model. American Journal of Managed Care, 2013. 19(10): p. e359-e366.	2013	USA	Primary and secondary care	Framework development and a national stakeholder panel.
34	Gnaedinger, M., et al., Chronic conditions and multimorbidity in a primary care population: a study in the Swiss Sentinel Surveillance Network (Sentinella). International Journal of Public Health.	2018	Switzerland	Primary care	Prevalence study
35	Hadgraft, N.T., et al., Reducing occupational sitting: Workers' perspectives on participation in a multi-component intervention. Int J Behav Nutr Phys Act, 2017. 14(1): p. 73.	2017	Australia	multi-component workplace	Qualitative study

				intervention	
36	Haggerty, J.L., Ordering the chaos for patients with multimorbidity. BMJ (Online), 2012. 345 (7876)(e5915).	2012	Canada	Primary care	Editorial
37	Heale, R., et al., Nurse practitioner's perceptions of the impact of the nurse practitioner-led clinic model on the quality of care of complex patients. Prim Health Care Res Dev, 2018: p. 1-8.	2018	Canada	Primary care	Qualitative study
38	Heisler, M., Eliciting Personal Values of Patients with Multiple Chronic Conditions: Why and How. Journal of General Internal Medicine, 2017. 32(12): p. 1273-1274.	2017	USA	Not specific	Qualitative study
39	Higashi, T., et al., Relationship between number of medical conditions and quality of care. New England Journal of Medicine, 2007. 356(24): p. 2496-2504.	2007	USA	Primary care	Qualitative study (telephone interviews)
40	Hijazi, H.H., et al., Risk assessment of comorbidities on 30-day avoidable hospital readmissions among internal medicine patients. J Eval Clin Pract, 2017. 23(2): p. 391-401.	2017	Jordan	Secondary care (hospital-internal medicine patients)	retrospective record review
41	Holland, D.E., et al., Exploring indicators of use of costly health services in community-dwelling adults with multiple chronic conditions. Professional case management, 2015. 20(1): p. 3-11; quiz 12-3.	2015	USA	Primary care	secondary analysis
42	Huntley, A.L., et al., Measures of multimorbidity and morbidity burden for use in primary care and community settings: a systematic review and guide. Annals of family medicine, 2012. 10(2): p. 134-141.	2012	USA, Canada, Europe, or Australia	Primary care (generalist primary care or population settings)	Systematic review
43	Iezzoni, L.I., Multiple chronic conditions and disabilities: Implications for health services research and data demands. Health Services Research, 2010. 45(5 PART 2): p. 1523-1540.	2010	USA	Not specific	Review
44	Ihle, A., et al., Prospective and retrospective memory are differentially related to self-rated omission and commission errors in medication adherence in multimorbidity. Appl Neuropsychol Adult, 2017. 24(6): p. 505-511.	2017	Switzerland	Primary and secondary care (Internal Medicine	Cohort study

				Department and the Cardiology Department of the University Hospital Zurich as well as in doctors' practices, pharmacies, and online medical web portals)	
45	Kahn, L.S., et al., Facilitating quality improvement in physician management of comorbid chronic disease in an urban minority practice. Journal of the National Medical Association, 2007. 99(4): p. 377-383.	2007	USA	Primary care (family medicine practice)	Audit
46	Kontopantelis, E., et al., Associations between exemption and survival outcomes in the UK's primary care pay-for-performance programme: A retrospective cohort study. BMJ Quality and Safety, 2016. 25(9): p. 657-670.	2016	UK	Primary care (general practices)	Retrospective longitudinal study
47	Krause, C.M., et al., The impact of a multidisciplinary, integrated approach on improving the health and quality of care for individuals dealing with multiple chronic conditions. American Journal of Orthopsychiatry, 2006. 76(1): p. 109-114.	2006	USA	Secondary care (hospitals)	Questionnaire study
48	LeRoy, L., et al., The agency for healthcare research and quality multiple chronic conditions research network: Overview of research contributions and future priorities. Medical Care, 2014. 52(3 SUPPL. 2): p. S15-S22.	2014	USA	Not specific	Cohort study
49	Mair, F.S. and C.R. May, Thinking about the burden of treatment: Should it be regarded as an indicator of the quality of care? BMJ (Online), 2014. 349(g6680).	2014	UK	Not specific	Editorial
50	Mangin, D., I. Heath, and M. Jamoulle, Beyond diagnosis: Rising to the multimorbidity challenge. BMJ (Online), 2012. 344 (7865)(e3526).	2012	Not specified	Not specific	Editorial
51	Marengoni, A., Guidelines for elderly patients with multimorbidity: How to cope with a dark night without fear. Aging Clinical and Experimental Research, 2013. 25(6): p.	2013	Italy	Not specific	Point of view

	703-705.				
52	Mas, M.A., Capsule Commentary on Bennett et al., Engaging Stakeholders to Inform Clinical Practice Guidelines that Address Multiple Chronic Conditions. Journal of General Internal Medicine, 2017. 32(8): p. 918.	2017	Spain	Not specific	Modified Delphi method
53	Melchiorre, M.G., et al., eHealth in integrated care programs for people with multimorbidity in Europe: Insights from the ICARE4EU project. Health Policy, 2018. 122(1): p. 53-63.	2018	Europe	Primary and secondary care (General and university hospitals)	Survey, literature review and qualitative study
54	Min, L., et al., Contrasting effects of geriatric versus general medical multimorbidity on quality of ambulatory care. Journal of the American Geriatrics Society, 2014. 62(9): p. 1714-1721.	2014	USA	Ambulatory care	Cross-sectional observation
55	Min, L.C., et al., Multimorbidity is associated with better quality of care among vulnerable elders. Medical Care, 2007. 45(6): p. 480-488.	2007	USA	Primary and secondary care (medical and geriatric care)	observational cohort study
56	Moran, W.P., et al., Chaos to complexity: leveling the playing field for measuring value in primary care. Journal of Evaluation in Clinical Practice, 2017. 23(2): p. 430-438.	2017	USA	Primary care	retrospective cohort analysis
57	Narayan, S.W. and P.S. Nishtala, Development and validation of a Medicines Comorbidity Index for older people. European Journal of Clinical Pharmacology, 2017. 73(12): p. 1665-1672.	2017	New Zealand	Primary and secondary care administrative databases	retrospective cohort study
58	Ndukwe, K., E. Burns, and J. Johnson, Multiple morbidity and functional status in older adults. Journal of the American Geriatrics Society, 2017. 65 (Supplement 1): p. S248.	2017	USA, Germany, Italy, Spain, Canada, Australia, India, UK, Turkey, Sweden, Netherlands	Primary care or community	Systematic review
59	OECD, *Patient-Reported Indicators Survey (PaRIS)*. 2017.	2017	Not specific	Not specific	Survey
60	Ozminkowski, R.J., et al., Big Data, Little Data, and Care Coordination for Medicare Beneficiaries with Medigap Coverage. Big data, 2015. 3(2): p. 114-125.	2015	USA	Not specific	Care coordination programme
61	Palmer, K., et al., Multimorbidity care model: Recommendations from the consensus meeting of the Joint Action on Chronic Diseases and Promoting Healthy Ageing	2018	Belgium	Primary and secondary care (physicians with	Consensus meeting

	across the Life Cycle (JA-CHRODIS). Health Policy, 2018. 122(1): p. 4-11.			different specialties (neurologists, geriatricians, internists, cardiologists, endocrinologists, diabetologists), epidemiologists, psychologists, representatives from patient organizations, and several General Practitioners.)	
62	Panagioti, M., et al., Multimorbidity and Patient Safety Incidents in Primary Care: A Systematic Review and Meta-Analysis. PLoS One, 2015. 10(8).	2015	USA, Australia, Germany, Spain, Canada, Netherlands, Italy, Ireland, Taiwan,	Primary care	Systematic review
63	Parekh, A.K., et al., Managing Multiple Chronic Conditions: A Strategic Framework for Improving Health Outcomes and Quality of Life, in Public Health Reports. 2011.	2011	USA	Not specific	Framework
64	Pillay, M., S. Dennis, and M.F. Harris, Quality of care measures in multimorbidity. Aust Fam Physician, 2014. 43(3): p. 132-6.	2014	Not specified	primary care	Systematic review
65	Ricci-Cabello, I., et al., Impact of multi-morbidity on quality of healthcare and its implications for health policy, research and clinical practice. A scoping review. Eur J Gen Pract, 2015. 21(3): p. 192-202.	2015	USA	Not specific	Scooping review
66	Rijken, M., et al., Chronic Disease Management Programmes: an adequate response to patients' needs? Health Expect, 2014. 17(5): p. 608-21.	2014	Europe	Primary care	Literature review and survey
67	Rijken, M., et al., How to improve care for people with multimorbidity in Europe? 2017, ICARE4EU.		Denmark	Not specific	Policy brief
68	Ruscitto, A., et al., Accounting for multimorbidity in pay for performance: A modelling study using UK Quality and	2016	UK	Not specific	Comment

	Outcomes Framework data. British Journal of General Practice, 2016. 66(649): p. e561-e567.				
69	Salisbury, C., Multimorbidity: Redesigning health care for people who use it. The Lancet, 2012. 380(9836): p. 7-9.	2012	UK	Not specific	Comment
70	Sampalli, T., et al., Proposed model of integrated care to improve health outcomes for individuals with multimorbidities. Patient Preference and Adherence, 2012. 6: p. 757-764.	2012	Not specified	Primary care	Review
71	Schiotz, M.L., et al., Quality of care for people with multimorbidity - a case series. BMC health services research, 2017. 17(1): p. 745.	2017	Denmark	Primary care	A case series
72	Shadmi, E., et al., Morbidity and older persons' perceptions of the quality of their primary care. Journal of the American Geriatrics Society, 2006. **54**(2): p. 330-334.	2006	Israel	Primary care	Cross-sectional study
73	Snyder, L., et al., Pay-for-performance principles that promote patient-centered care: an ethics manifesto. Annals of Internal Medicine, 2007. **147**(11): p. 792-4.	2007	USA	Not specific	Position paper
74	Streit, S., et al., Multimorbidity and quality of preventive care in Swiss University primary care cohorts. PLoS ONE, 2014. 9 (4) (no pagination)(e96142).	2014	Switzerland	Primary care	Retrospective cohort study
75	Tinetti, M.E. and S.A. Studenski, *Comparative effectiveness research and patients with multiple chronic conditions.* New England Journal of Medicine, 2011. **364**(26): p. 2478-2481.	2011	Not specified	Not specific	Perspective
76	Uhlig, K., et al., A Framework for Crafting Clinical Practice Guidelines that are Relevant to the Care and Management of People with Multimorbidity. Journal of General Internal Medicine, 2014. 29(4): p. 670-9.	2014	Not specified	Not specific	Literature
77	van der Heide, I., et al., How to strengthen patientcentredness in caring for people with multimorbidity in Europe? 2017, ICARE4EU.	2017	Europe	Not specific	Policy brief
78	Venkatesh, A., K. Goodrich, and P.H. Conway, Opportunities for quality measurement to improve the value of care for patients with multiple chronic conditions. Annals of Internal Medicine, 2014. 161(Supplement 10): p. S76-S80.	2014	Not specified	Not specific	Review
	Vetrano, D.L., et al., An international perspective on chronic	2017	Not specified	Not specific	Review

79	multimorbidity: approaching the elephant in the room. The journals of gerontology. Series A, Biological sciences and medical sciences, 2017.				
80	Vogeli, C., et al., Multiple chronic conditions: Prevalence, health consequences, and implications for quality, care management, and costs. Journal of General Internal Medicine, 2007. 22(SUPPL. 3): p. 391-395.	2007	Not specified	Not specific	Review
81	Wallace, E., et al., Comparison of count-based multimorbidity measures in predicting emergency admission and functional decline in older community-dwelling adults: a prospective cohort study. BMJ open, 2016. 6(9): p. e013089.	2016	Ireland	Primary care (General practices)	prospective cohort study
82	Wittenberg, R., The challenge of measuring multi-morbidity and its costs. Israel Journal of Health Policy Research, 2015. 4 (1) (no pagination)(1).	2015	UK	Primary care	Cross-sectional study.
83	Wodchis, W.P., Performance Measurement for People with Multimorbidity and Complex Health Needs. Health Quarterly, 2016. 19(2).	2016	Not specified	Not specific	Review
84	Zulman, D.M., et al., Quality of care for patients with multiple chronic conditions: The role of comorbidity interrelatedness. Journal of General Internal Medicine, 2014. 29(3): p. 529-537.	2014	Not specified	Primary care, geriatrics, and mental health care	Review
85	Leijten, F.R.M., et al., Defining good health and care from the perspective of persons with multimorbidity: results from a qualitative study of focus groups in eight European countries. BMJ Open, 2018. 8(8): p. e021072.	2018	Austria, Croatia, Germany, Hungary, the Netherlands, Norway, Spain and the UK	Not specific	Qualitative study
86	Roland, M. and C. Paddison, Better management of patients with multimorbidity. BMJ, 2013. 346: p. f2510.	2013	UK	Primary and secondary care	Analysis
87	Ricci-Cabello, I., et al., Impact of the prevalence of concordant and discordant conditions on the quality of diabetes care in family practices in England. The Annals of Family Medicine, 2015. **13**(6): p. 514-522.	2015	UK	Primary care	Cross-sectional study