

Continuity of medication management and continuity of care: Conceptual and operational considerations

SAGE Open Medicine
2: 2050312114559261
© The Author(s) 2014
Reprints and permissions:
sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/2050312114559261
smo.sagepub.com

Christopher A Beadles¹, Corrine I Voils^{1,2}, Matthew J Crowley^{1,3}, Joel F Farley⁴ and Matthew L Maciejewski^{1,2}

Abstract

Objective: Continuity of care is considered foundational to high-quality care. Traditional continuity of care constructs may adequately characterize care quality in general populations, but may merit reconceptualization for patients with multiple chronic conditions. Specifically, interactions between multiple chronic condition patients and providers involve complex medication management; therefore care continuity measurement may be more relevant if focused on the provider subset who prescribes essential medications for chronic conditions—a construct we call continuity of medication management. Our objective was to explore conceptual distinctions between continuity of medication management and continuity of care, survey existing evidence in this area, and discuss implications of our findings for future research and intervention development.

Methods: In this topical review, we discuss conceptual distinctions between continuity of medication management and continuity of care, review the limited continuity of medication management-related empirical evidence, and discuss implications for future research and interventions.

Results: Continuity of medication management represents a potential conceptual and measurement advance by reflecting interpersonal continuity and management continuity, and may provide a means of identifying patients at high-risk of adverse events. Empirical evidence also establishes support for continuity of medication management as a meaningful measure of care continuity. Finally, continuity of medication management may also be a potential target for future intervention to improve care delivery among multiple chronic condition patients.

Conclusion: If continuity of medication management is validated in diverse populations, correlated with patient outcomes, and responsive to change, then it may be an important target for improving the health and health care of multiple chronic condition patients.

Keywords

Veterans, continuity of care, medication, chronic conditions, providers, prescribers

Date received: 26 June 2014; accepted: 16 October 2014

Introduction

Continuity of care is a well-established concept spanning five decades of research and is considered fundamental to high-quality primary care.^{1–9} Prior observational research indicates that more coordinated care, defined as receiving care from a single provider (or single team), is associated with better care experiences,^{3,10,11} fewer emergency department visits, and fewer hospitalizations.^{3,12} Conversely, fragmented care from multiple providers has been associated with duplication of services, medications, diagnostic tests, and procedures.^{13–16} Increasing number of providers and chronic medications has been associated with greater risk of adverse drug events and drug–drug interactions.^{17–20}

¹Center for Health Services Research in Primary Care (152), Durham VA Medical Center, Durham, NC, USA

²Division of General Internal Medicine, Department of Medicine, Duke University, Durham, NC, USA

³Division of Endocrinology, Department of Medicine, Duke University, Durham, NC, USA

⁴Division of Pharmaceutical Outcomes and Policy, School of Pharmacy, University of North Carolina, Chapel Hill, NC, USA

Corresponding author:

Matthew L Maciejewski, Center for Health Services Research in Primary Care (152), Durham VA Medical Center, 411 West Chapel Hill Street, Suite 600, Durham, NC 27705, USA.
Email: matthew.maciejewski@va.gov



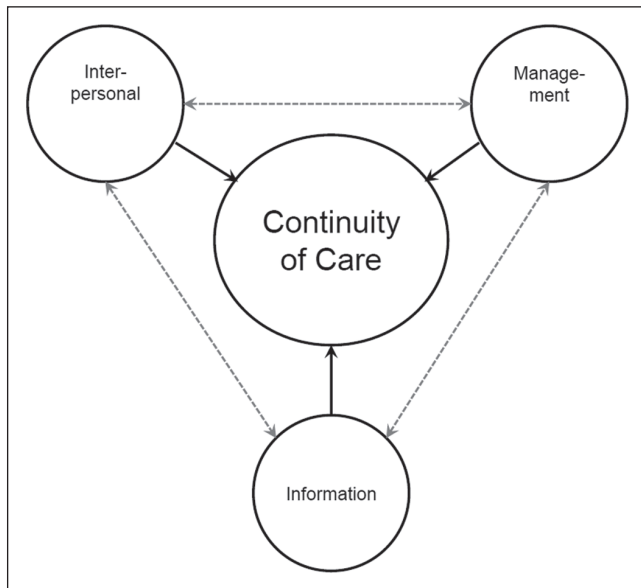


Figure 1. Conceptual model of continuity of care and component dimensions.

Continuity of care is a centerpiece of Accountable Care Organizations (ACOs) and Patient Centered Medical Homes (PCMHs),^{21,22} although evidence is mixed about whether these care delivery models improve care coordination and quality of care or reduce health expenditures.^{23–26} Most improvements in health and economic outcomes appear to be concentrated in patients with multiple chronic conditions (MCCs).²⁷ To realize the greatest outcome improvements for MCC patients, it may be useful to reconceptualize continuity of care in terms of the clinical realities of MCC patients. These patients incur a disproportionate share of health expenditures,^{28,29} often see more providers,³⁰ and require more complex medication regimens than patients with a single chronic condition.³¹

For MCC patients, continuity of care may be more relevant if considered in relation to the subset of providers who prescribe medications essential for managing their chronic conditions. We refer to this restriction of continuity of care to prescribers of medications for managing chronic conditions as continuity of medication management (COMM). The degree of conceptual and empirical overlap between traditional continuity of care measures and COMM is unknown. Our definition of medication management focuses upon actions taken by a physician or other health-care provider prescribing medications, because we seek to understand the role of potentially divergent medical care received from multiple autonomous prescribers on outcomes for MCC patients. COMM is considered from the perspective of the prescriber who must manage the medication regimen of an MCC patient in terms of changing doses, switching medications, adding medications, and conducting medication reconciliation more generally. Conceptual clarity about the role of discordant medical care from prescribers could eventually inform

refinement of existing care coordination interventions^{32–35} designed to improve the acquisition, organization, and administration of necessary medications for MCC patients.

Conceptual framework for continuity of care

Continuity of care has been conceptualized as comprising three distinct but related latent constructs that are essential elements of an idealized conceptualization of continuity: interpersonal continuity, management continuity, and informational continuity (Figure 1).^{36,37} Interpersonal continuity has been defined as an ongoing therapeutic relationship between a patient and the same provider (or care team) in the same place with the same medical record. Saultz³⁶ referred to interpersonal continuity as a special type of longitudinal continuity in which provider and patient interactions are “characterized by personal trust and responsibility.” Without interpersonal continuity, the therapeutic relationship may suffer due to lack of mutual familiarity and trust between patients and their providers. Management continuity has been defined as the extent to which services delivered by different providers are timely and complementary such that care is experienced as connected and coherent.³⁷ Ideally, management continuity should also incorporate patients’ preferences and changing priorities in care planning. Without management continuity, patients may experience discordant plans from different providers, leading to poorer outcomes and lower patient satisfaction. Informational continuity refers to a provider’s access to comprehensive information about a patient’s previous health-care encounters, medical history, and circumstances. Without informational continuity, care may be duplicative and wasteful.

These three constructs underlying the latent construct of idealized care continuity are represented by solid lines in Figure 1. The dotted lines between constructs in Figure 1 represent the inter-relationships between constructs, because one construct may influence or build upon another. Interpersonal and management continuity are enhanced by high-level informational continuity. For example, complete provider knowledge of all care provided to a given patient augments interpersonal continuity by facilitating provider–patient rapport and trust. Complete provider knowledge also facilitates greater care coordination and resolution of discordant care plans, which should bolster management continuity. Informational continuity may be improved by multiple providers seeing a single patient if they all utilize a single integrated electronic health record (EHR). In the absence of integrated EHR, informational continuity remains possible if providers communicate directly with one another.

Although interpersonal and management continuity are generally likely to be positively correlated, patients may experience high continuity along one dimension but discontinuity along another dimension. For example, management continuity might be optimal if all pharmaceutical, procedural,

and other care for a particular patient were clinically appropriate and had undergone comprehensive review by a single provider to avoid drug–drug interactions and duplicate tests. However, interpersonal continuity might be suboptimal if this patient had frequent clinical encounters with other providers (even if in the same practice). Management continuity for this patient would worsen if the various providers made changes to the patient’s medication regimen or made new treatment decisions without the primary provider’s knowledge. In the absence of complete informational continuity enabled by a comprehensive integrated EHR or receipt of all care in the same medical group, it is common for such treatment decisions to be made in isolation.

Ideally, continuity of care measures should reflect all three conceptual domains, but most claims-based measures primarily represent interpersonal continuity because they aggregate the number of providers seen in face-to-face encounters over a defined period of time.³⁸ Existing continuity of care measures typically do not account for the individual clinical actions taken by different providers that reflect management continuity. Similarly, we are unaware of any validated claims-based measure of informational continuity, but survey-based continuity of care measures have been developed to measure all three constructs.^{39,40} However, such survey measures are more costly to collect and thus less scalable than claims-based measures. As a result of these conceptual and measurement limitations in existing measures, much of the claims-based evidence base between continuity of care and patient outcomes is based on measures of interpersonal continuity. There remains a need for claims-based measures that reflect a greater number of continuity of care domains. COMM was developed to fill this need.

Methods

We introduce a novel conceptual construct, COMM, which complements existing continuity of care measures and may be particularly relevant to MCC patients. We discuss how COMM reflects more of the domains of care continuity (interpersonal, management, and informational) than traditional continuity of care measures, and their conceptual similarities and distinctions. We then provide a topical review of empirical studies that examine COMM-related constructs to provide context to the preceding discussion of conceptual issues. We conclude with a discussion of implications of COMM as a target for intervention development or a mechanism to identify target subgroups for care coordination interventions. As ACOs and PCMHs evolve in the coming years to increase their effectiveness, COMM may represent an important means by which health and health care for MCC patients can be improved. Human subjects approval was obtained from the Institutional Review Boards at the Durham Veterans Administration Medical Center (VAMC), Duke University, and the University of North Carolina.

Results of COMM and continuity of care construct comparison

We define our novel concept, COMM, as the subset of providers who prescribe essential medications for managing chronic conditions among MCC patients. In prior work, we have operationalized COMM as a count of prescribers of essential medications.^{41,42} COMM is conceptually related to but distinct from traditional continuity of care measures in three respects (Table 1). First, the unit of measurement for each construct differs. Most continuity measures are calculated based on the number of unique provider–patient encounters for preventive, acute, and chronic care in a specified timeframe, such as 1 year. In contrast, the unit of measurement for COMM is the number of unique provider-prescriptions for essential medications in chronic disease management because these medications are a central, measurable clinical “product” of health-care interactions with many MCC patients. Not all providers prescribe essential medications for managing chronic conditions, so prescribers of essential medications often represent a subset of the providers included in a typical continuity of care measure.

A second implication of differing units of measurement is that COMM is relatively unaffected by acute or preventive care encounters. That is, providers are excluded in the measure if they do not prescribe essential medications for managing a chronic disease. Excluding acute and preventive care from continuity considerations among MCC patients may be appropriate for two reasons. For these patients, discontinuity in preventive care may be less impactful on their health and care utilization than discontinuity in their chronic disease care, and discontinuity in acute care may be less impactful for short-term medications that do not induce interactions with essential medications. For example, consider a situation in which an MCC patient visits one provider for treatment of a urinary tract infection who prescribes antibiotics, a second provider for a flu-shot who does not prescribe medications, and a third provider who prescribes diabetes medications. In this example, a traditional continuity of care measure would include all three providers, whereas our COMM measure would only include the third provider.

A third way in which continuity of care and COMM measures differ is that claims-based continuity of care measures solely represent interpersonal continuity, while COMM represents interpersonal and management continuity. Claims-based measures of continuity of care weigh all encounters with all providers equally, regardless of care (acute, preventive, or chronic) or services provided (counseling, procedure, or prescription). In traditional continuity of care measures, a 5-min flu-shot weighs equally with a comprehensive 45-min medication reconciliation visit. This strategy may be adequate for measuring interpersonal continuity, but does not reflect management continuity. Management continuity may be as important as or more important than interpersonal continuity in caring for MCC patients, so a claims-based measure that

Table 1. Conceptual issues in continuity of medication management and care continuity.

	Continuity of care as traditionally defined	Continuity of medication management
Unit of attribution	Provider encounters	Prescriptions
Broadly includes	Any provider in face-to-face encounter in current year	Any provider prescribing a medication in current year
Practically includes	Providers of outpatient care, but typically restricted to primary care	Providers prescribing medications indicated for chronic conditions
Implied ideal	Fewer providers, with some exceptions, is associated with higher care quality	Fewer prescribers, with some exceptions, is associated with higher quality care
Reflects actions taken by providers?	No	Yes (via medications prescribed)
Inherent assumptions (broad)	Number of providers is most closely associated with the interpersonal dimension of continuity of care	Number of prescribers is most closely associated with the management dimension of continuity of care
Inherent assumptions (narrow)	Having fewer providers yields efficiencies in provision of care, fewer opportunities for conflicting care plans and repeated tests	Having fewer prescribers decreases potential for drug–drug interactions, drug duplications, and discrepancies in dose regimens
Limitations	1) Intensity of care provided not reflected 2) Outpatient care only 3) Appropriate specialist referral not considered	4) Covering prescriber not considered 5) Outpatient care only 6) OTC, and nonmedication management not considered 7) Appropriate referral medication change not considered
How affected by acute care episode?	Measure unaffected if patient sees usual provider, but is reduced if patient goes to ER, urgent care or other new providers	Measure unaffected if patient obtains no new medication; COMM is reduced if patient obtains chronic medication from prescriber in ER, urgent care, or other setting

OTC: over the counter; ER: emergency room; COMM: continuity of medication management.

represents both domains may be particularly meaningful for MCC patients. Since COMM is constructed on the basis of medication data (a central, measurable product of the encounter), it represents both interpersonal continuity (the number of prescribers involved in a patient's care) and management continuity (clinical actions providers take as a result of jointly determined therapeutic plans). Thus, COMM reflects the clinical reality that encounters for MCC patients that address medication management and disease control may be particularly influential on health relative to preventive or acute care encounters.

Results of topical review

These conceptual distinctions between COMM and continuity of care suggest that poor COMM, operationalized as a greater number of prescribers, would be a significant risk factor for adverse events among vulnerable or MCC patients. Despite an increasing number of studies associating patient outcomes with multimorbidity^{17,28,43–51} and the well-known risks of poorly managed polypharmacy, there are few studies of COMM. The first study (to our knowledge) of COMM-related associations in a sample of 315 elderly inpatients found that risk of hospital admission due to medication non-adherence increased with the number of physicians regularly seen, even after adjusting for sex, the number of prescription medications, and patient recall of medication regimen.⁵² In a

study of 51,587 elderly patients taking cardiovascular, psychotropic, or nonsteroidal anti-inflammatory drugs, the number of prescribers was a stronger predictor (Odds Ratio (OR)=1.44–1.71) of potentially inappropriate drug combinations than the number of providers (OR=1.17–1.39).⁵³ In a study of 384 elderly veterans, having multiple prescribers was more predictive (OR=3.35, $p=0.03$) of having unnecessary drug use at hospital discharge than age, gender, race, marital status, education, employment, the Charlson index, activities of daily living, or number of prescribed medications.⁵⁴ In a study of 405 elderly Medicare beneficiaries enrolled in a Pennsylvania managed care plan, having more prescribers was associated with a greater risk of adverse drug events (OR=1.3, $p=0.02$),⁵⁵ but was less predictive than having four or more chronic conditions.

We recently conducted analyses of outcomes associated with having multiple prescribers for patients with chronic conditions in Medicaid and the Veterans Administration (VA). In a study of 7868 Medicaid patients with schizophrenia in North Carolina, patients with three prescribers were significantly more likely than patients with one prescriber to switch anti-psychotic medications ($p<0.01$) and to be either fully adherent or over-adherent ($p<0.001$).⁴¹ In a sample of Veterans with diabetes, hypertension, dyslipidemia, or heart failure during 2008–2010 at a single VAMC in North Carolina, we found that more prescribers of cardiometabolic medications was associated with medication

refill nonadherence.⁵⁶ We also found that the number of cardiometabolic medication prescribers was positively associated with more all-cause and cardiometabolic-specific emergency room (ER) visits (all-cause: two prescribers, OR=1.16; three prescribers, OR=1.21; 4+ prescribers, OR=1.39) and inpatient admissions (all-cause: two prescribers, OR=1.27; three prescribers, OR=1.30; 4+ prescribers, OR=1.34).⁴² Results from these studies indicate that having multiple prescribers is one of the strongest predictors of adverse drug events and avoidable utilization, which suggests that COMM may be a critical risk factor by which multimorbidity is associated with health-care utilization.

Discussion

There is value in greater conceptual and empirical clarity about whether all three continuity domains or specific domains are particularly relevant to MCC patients, because persons with MCC under care of multiple providers are increasingly prevalent. Furthermore, intuitively promising care models have not been able to effectively improve health outcomes and contain expenditures of MCC patients.^{27,35,57–59} Bending the cost curve in any segment of the US health-care system will require improved management of MCC patients, and care continuity is likely to be an important part of effective care models. COMM represents a potentially useful conceptual and empirical refinement of continuity of care that may be particularly relevant for improving the care management of MCC patients. Existing empirical evidence suggests that increasing number of prescribers is strongly associated with adverse medication-related outcomes and avoidable utilization, suggesting that COMM may be a meaningful construct for identifying patients at risk of adverse events.

To have greater confidence that COMM is a predictive risk factor for adverse events, future research is needed in two areas. First, there is a need to evaluate whether COMM is more strongly associated with adverse events of MCC patients than traditional claims-based continuity of care measures. In a study of 5586 adolescents, the number of prescribers of asthma medications was significantly associated with ER visits and hospital admissions for asthma, but a care continuity measure representing the total number of prescribers was uncorrelated with these same outcomes.⁶⁰ Similar comparative analyses need to be conducted in adult populations across a broader array of outcomes.

Future research is also needed that examines whether results from the prior COMM-related studies in Veteran,^{42,54,56} Medicaid,⁴¹ and Medicare Advantage⁵⁵ populations generalize to Medicare and commercially-insured populations. If COMM is shown to be more strongly associated with a range of outcomes in adult populations than continuity of care measures and significant associations are found across treatment settings, then this would suggest that COMM may be a novel indicator of risk for suboptimal quality of care.

In addition to a care quality measurement, COMM may have predictive value for broadly defined preventable adverse events. Marek and colleagues³³ have demonstrated positive effects of nurse care coordination on patient self-management of medications, while Naylor and associates³² have described benefits of a comprehensive transitional care intervention for heart failure patients. However, several recent care coordination interventions for MCC patients failed to improve outcomes or reduce expenditures on average,^{27,58,59} but realized expenditure reductions among a subset of high-risk patients.^{27,34,59} Comparison across these interventions is difficult because the definition of high-risk varied between these three studies; addressing either risk of hospital readmission^{34,59} or including a broad risk adjustment score based on costs, diagnosed conditions, and demographic factors.²⁷ COMM represents a potential alternative mechanism to characterize patients at high-risk for adverse events across a range of outcomes, not limited to hospital readmission risk. However, this will also require validation and will likely need to be delivered alongside patient-level interventions effective at improving medication taking behavior of MCC patients, because nonadherence is a complex multimodal challenge.

Finally, COMM may be a suitable target of intervention for care coordination. In order to further pursue COMM in this manner, the “active ingredient” or construct among MCC patients must be established.⁶¹ If management continuity is the “active ingredient,” then patients of providers with current and comprehensive care plans that match patient priorities and desires should have optimal outcomes. If, however, interpersonal continuity is the “active ingredient,” then patients with a single provider or patients with a primary care provider (PCP) that coordinates well with specialists and other PCPs should have optimal outcomes. If informational continuity is the “active ingredient” and EHRs are optimally structured for efficient information extraction by providers, then patients in health systems with such EHRs and providers who excel at information extraction should have optimal outcomes. To investigate this, future research should be conducted to develop and validate a measure of informational continuity from claims data or EHR data. A claims-based measure would enable examination of whether informational continuity is a key factor differentiating effective care coordination interventions, such as high-quality PCMHs, from ineffective interventions, such as low-quality PCMHs.

Greater insight about the key domains of continuity of care that improves patient outcomes, particularly for MCC patients, is needed. Such insights could further inform the value of COMM among MCC patients as well as the next generation of ACOs and PCMHs. Until these issues are well understood, it will be difficult to improve upon current care continuity measurement and care coordination interventions or to develop new interventions to improve outcomes of MCC patients.

Conclusion

This topical review outlined the conceptual distinctions between COMM and continuity of care and reviewed the limited research related to COMM. COMM represents a potential advance on conceptualization and measurement for continuity of care by reflecting both interpersonal continuity and management continuity. Opportunities exist to substantiate COMM as a predictive construct for research and clinical practice. If COMM is validated in diverse populations, correlated with patient outcomes, and responsive to change, then it may be an important target for improving the health and health care of MCC patients.

Acknowledgements

We would like to thank Elizabeth Bayliss for helpful comments. A preliminary version of this article was presented as a poster at Academy Health Annual Research Meeting 2014.

Declaration of conflicting interests

Drs Maciejewski and Farley have received consultation funds from Daiichi Sankyo. Dr Maciejewski has received consultation funds from ResDAC at the University of Minnesota, and owns stock in Amgen due to his spouse's employment. Other authors have no known conflicts of interest. The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veteran Affairs, Duke University, or the University of North Carolina at Chapel Hill.

Funding

This research was funded by the Agency for Healthcare Policy and Research (R21 HS019445). This work was also supported by the Office of Research and Development, Health Services Research and Development Service, Department of Veterans Affairs. Dr Maciejewski was also supported by a Research Career Scientist award from the Department of Veterans Affairs (RCS 10-391).

References

1. Becker MH, Drachman RH and Kirscht JP. A field experiment to evaluate various outcomes of continuity of physician care. *Am J Public Health* 1974; 64(11): 1062–1070.
2. Gonnella JS and Herman MW. Continuity of care. *JAMA* 1980; 243(4): 352–354.
3. Wasson JH, Sauvigne AE, Mogielnicki RP, et al. Continuity of outpatient medical care in elderly men. A randomized trial. *JAMA* 1984; 252(17): 2413–2417.
4. Weiss LJ and Blustein J. Faithful patients: the effect of long-term physician-patient relationships on the costs and use of health care by older Americans. *Am J Public Health* 1996; 86(12): 1742–1747.
5. Gill JM and Mainous AG 3rd. The role of provider continuity in preventing hospitalizations. *Arch Fam Med* 1998; 7(4): 352–357.
6. Mainous AG 3rd, Baker R, Love MM, et al. Continuity of care and trust in one's physician: evidence from primary care in the United States and the United Kingdom. *Fam Med* 2001; 33(1): 22–27.
7. Cabana MD and Jee SH. Does continuity of care improve patient outcomes? *J Fam Pract* 2004; 53(12): 974–980.
8. Chen CC and Chen SH. Better continuity of care reduces costs for diabetic patients. *Am J Manag Care* 2011; 17(6): 420–427.
9. Katz DA, McCoy K and Sarrazin MV. Does improved continuity of primary care affect clinician-patient communication in VA? *J Gen Intern Med* 2014; 29: S682–S688.
10. Rodriguez HP, Rogers WH, Marshall RE, et al. The effects of primary care physician visit continuity on patients' experiences with care. *J Gen Intern Med* 2007; 22(6): 787–793.
11. Rodriguez HP, Rogers WH, Marshall RE, et al. Multidisciplinary primary care teams: effects on the quality of clinician-patient interactions and organizational features of care. *Med Care* 2007; 45(1): 19–27.
12. Gill JM, Mainous AG 3rd and Nsereko M. The effect of continuity of care on emergency department use. *Arch Fam Med* 2000; 9(4): 333–338.
13. Goodwin JS, Asrabadi A, Howrey B, et al. Multiple measurement of serum lipids in the elderly. *Med Care* 2011; 49(2): 225–230.
14. Chu HY, Chen CC and Cheng SH. Continuity of care, potentially inappropriate medication, and health care outcomes among the elderly: evidence from a longitudinal analysis in Taiwan. *Med Care* 2012; 50(11): 1002–1009.
15. Smith PC, Araya-Guerra R, Bublitz C, et al. Missing clinical information during primary care visits. *JAMA* 2005; 293(5): 565–571.
16. Bourgeois FC, Olson KL and Mandl KD. Patients treated at multiple acute health care facilities: quantifying information fragmentation. *Arch Intern Med* 2010; 170(22): 1989–1995.
17. Boyd CM, Darer J, Boulton 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(6): 716–724.
18. Tinetti ME, Bogardus ST Jr and Agostini JV. Potential pitfalls of disease-specific guidelines for patients with multiple conditions. *N Engl J Med* 2004; 351(27): 2870–2874.
19. Gandhi TK, Weingart SN, Borus J, et al. Adverse drug events in ambulatory care. *N Engl J Med* 2003; 348(16): 1556–1564.
20. Gurwitz JH, Field TS, Harrold LR, et al. Incidence and preventability of adverse drug events among older persons in the ambulatory setting. *JAMA* 2003; 289(9): 1107–1116.
21. Ferrante JM, Balasubramanian BA, Hudson SV, et al. Principles of the patient-centered medical home and preventive services delivery. *Ann Fam Med* 2010; 8(2): 108–116.
22. McWilliams JM, Chernew ME, Zaslavsky AM, et al. Post-acute care and ACOs—who will be accountable? *Health Serv Res* 2013; 48(4): 1526–1538.
23. Reid RJ, Fishman PA, Yu O, et al. Patient-centered medical home demonstration: a prospective, quasi-experimental, before and after evaluation. *Am J Manag Care* 2009; 15(9): e71–e87.
24. Alexander JA and Bae D. Does the patient-centred medical home work? A critical synthesis of research on patient-centred medical homes and patient-related outcomes. *Health Serv Manage Res* 2012; 25(2): 51–59.
25. Peikes D, Zutshi A, Genevro JL, et al. Early evaluations of the medical home: building on a promising start. *Am J Manag Care* 2012; 18(2): 105–116.

26. Jackson GL, Powers BJ, Chatterjee R, et al. The patient-centered medical home. *Ann Intern Med* 2013; 158(3): 169–178.
27. Higgins S, Chawla R, Colombo C, et al. Medical homes and cost and utilization among high-risk patients. *Am J Manag Care* 2014; 20(3): e61–e71.
28. Wolff JL, Starfield B and Anderson G. Prevalence, expenditures, and complications of multiple chronic conditions in the elderly. *Arch Intern Med* 2002; 162(20): 2269–2276.
29. Yoon J, Zulman D, Scott JY, et al. Costs associated with multimorbidity among VA patients. *Med Care* 2014; 52(Suppl. 3): S31–S36.
30. Pham HH, Schrag D, O'Malley AS, et al. Care patterns in Medicare and their implications for pay for performance. *N Engl J Med* 2007; 356(11): 1130–1139.
31. 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(Suppl. 3): 391–395.
32. Naylor MD, Broton DA, Campbell RL, et al. Transitional care of older adults hospitalized with heart failure: a randomized, controlled trial. *J Am Geriatr Soc* 2004; 52(5): 675–684.
33. Marek KD, Stetzer F, Ryan PA, et al. Nurse care coordination and technology effects on health status of frail older adults via enhanced self-management of medication: randomized clinical trial to test efficacy. *Nurs Res* 2013; 62(4): 269–278.
34. Brown R, Peikes D, Chen A, et al. 15-site randomized trial of coordinated care in Medicare FFS. *Health Care Financ Rev* 2008; 30(1): 5–25.
35. Boulton C, Leff B, Boyd CM, et al. A matched-pair cluster-randomized trial of guided care for high-risk older patients. *J Gen Intern Med* 2013; 28(5): 612–621.
36. Saultz JW. Defining and measuring interpersonal continuity of care. *Ann Fam Med* 2003; 1(3): 134–143.
37. Haggerty JL, Reid RJ, Freeman GK, et al. Continuity of care: a multidisciplinary review. *BMJ* 2003; 327(7425): 1219–1221.
38. Jee SH and Cabana MD. Indices for continuity of care: a systematic review of the literature. *Med Care Res Rev* 2006; 63(2): 158–188.
39. Haggerty JL, Roberge D, Freeman GK, et al. Validation of a generic measure of continuity of care: when patients encounter several clinicians. *Ann Fam Med* 2012; 10(5): 443–451.
40. Rodriguez HP, Marshall RE, Rogers WH, et al. Primary care physician visit continuity: a comparison of patient-reported and administratively derived measures. *J Gen Intern Med* 2008; 23(9): 1499–1502.
41. Farley JF, Wang CC, Hansen RA, et al. Continuity of antipsychotic medication management for Medicaid patients with schizophrenia. *Psychiatr Serv* 2011; 62(7): 747–752.
42. Maciejewski ML, Powers BJ, Sanders LL, et al. The intersection of patient complexity, prescriber continuity and acute care utilization. *J Gen Intern Med* 2014; 29(4): 594–601.
43. Steinman MA, Lee SJ, John Boscardin W, et al. Patterns of multimorbidity in elderly veterans. *J Am Geriatr Soc* 2012; 60(10): 1872–1880.
44. Bayliss EA, Ellis JL and Steiner JF. Barriers to self-management and quality-of-life outcomes in seniors with multimorbidities. *Ann Fam Med* 2007; 5(5): 395–402.
45. Bayliss EA. Simplifying care for complex patients. *Ann Fam Med* 2012; 10(1): 3–5.
46. Bayliss EA, Blatchford PJ, Newcomer SR, et al. The effect of incident cancer, depression and pulmonary disease exacerbations on type 2 diabetes control. *J Gen Intern Med* 2011; 26(6): 575–581.
47. Bayliss EA, Bosworth HB, Noel PH, et al. Supporting self-management for patients with complex medical needs: recommendations of a working group. *Chronic Illn* 2007; 3(2): 167–175.
48. Bayliss EA, Ellis JL and Steiner JF. Subjective assessments of comorbidity correlate with quality of life health outcomes: initial validation of a comorbidity assessment instrument. *Health Qual Life Outcomes* 2005; 3: 51.
49. Bayliss EA, Ellis JL and Steiner JF. Seniors' self-reported multimorbidity captured biopsychosocial factors not incorporated into two other data-based morbidity measures. *J Clin Epidemiol* 2009; 62(5): 550–557.
50. Tinetti ME and Studenski SA. Comparative effectiveness research and patients with multiple chronic conditions. *N Engl J Med* 2011; 364(26): 2478–2481.
51. Tinetti ME, Fried TR and Boyd CM. Designing health care for the most common chronic condition—multimorbidity. *JAMA* 2012; 307(23): 2493–2494.
52. Col N, Fanale JE and Kronholm P. The role of medication noncompliance and adverse drug reactions in hospitalizations of the elderly. *Arch Intern Med* 1990; 150(4): 841–845.
53. Tamblyn RM, McLeod PJ, Abrahamowicz M, et al. Do too many cooks spoil the broth? Multiple physician involvement in medical management of elderly patients and potentially inappropriate drug combinations. *CMAJ* 1996; 154(8): 1177–1184.
54. Hajjar ER, Hanlon JT, Sloane RJ, et al. Unnecessary drug use in frail older people at hospital discharge. *J Am Geriatr Soc* 2005; 53(9): 1518–1523.
55. Green JL, Hawley JN and Rask KJ. Is the number of prescribing physicians an independent risk factor for adverse drug events in an elderly outpatient population? *Am J Geriatr Pharmacother* 2007; 5(1): 31–39.
56. Hansen RA, Powers BJ, Sanders L, et al. Prescriber continuity and medication adherence for complex patients. *Ann Pharmacother*, in press.
57. Sidorov JE. The patient-centered medical home for chronic illness: is it ready for prime time? *Health Aff* 2008; 27(5): 1231–1234.
58. Peikes D, Chen A, Schore J, et al. Effects of care coordination on hospitalization, quality of care, and health care expenditures among Medicare beneficiaries: 15 randomized trials. *JAMA* 2009; 301(6): 603–618.
59. Counsell SR, Callahan CM, Tu W, et al. Cost analysis of the Geriatric Resources for Assessment and Care of Elders care management intervention. *J Am Geriatr Soc* 2009; 57(8): 1420–1426.
60. Cyr MC, Martens AC, Berbiche D, et al. Continuity of care in the ambulatory treatment of adolescents with asthma. *J Adolesc Health* 2006; 39(6): 926.e11–926.e17.
61. Freeman GK. Progress with relationship continuity 2012, a British perspective. *Int J Integr Care* 2012; 12: e128.