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Original Study

Development of an Interdisciplinary Team Communication Framework and Quality Metrics for Home-Based Medical Care Practices

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A B S T R A C T

Background: The unique needs of homebound adults receiving home-based medical care (HBMC) (ie, home-based primary care and home-based palliative care services) are ideally provided by interdisciplinary care teams (IDTs) that provide coordinated care. The composition of team members from an array of organizations and the unique dimension of providing care in the home present specific challenges to timely access and communication of patient care information. The objective of this work was to develop a conceptual framework and corresponding quality indicators (QIs) that assess how IDT members for HBMC practices access and communicate key patient information with each other.

Methods: A systematic review of peer-reviewed and gray literature was performed to inform a framework for care coordination in the home and the development of candidate QIs to assess processes by which all IDT members optimally access and use patient information. A technical expert panel (TEP) participated in a modified Delphi process to assess the validity and feasibility of each QI and to identify which would be most suitable for testing in the field.

Results: Thematic analysis of literature revealed 4 process themes for how HBMC practices might engage in high-quality care coordination: using electronic medical records, conducting interdisciplinary team meetings, sharing standardized patient assessments, and communicating via secure e-messaging. Based on these themes, 9 candidate QIs were developed to reflect these processes. Three candidate QIs were assessed by the TEP as valid and feasible to measure in an HBMC practice setting. These indicators focused on use of IDT meetings, standardized patient assessments, and secure e-messaging.

Conclusion: Translating the complex issue of care coordination into QIs will improve care delivered to vulnerable home-limited adults who receive HBMC. Guided by the literature, we developed a framework to reflect optimal care coordination in the home setting and identified 3 candidate QIs to field-test in HBMC practices.

There are an estimated 2 to 4 million homebound older adults in the United States today with functional impairments and multiple chronic conditions. This number is expected to increase with the aging population.[1,2] Home-based primary care and home-based palliative care (henceforth called home-based medical care [HBMC]) can provide high-quality, patient-centered, cost-effective care for homebound persons. First-year results from the Centers for Medicare and Medicaid Services (CMS) Innovation Center's Independence at Home Demonstration showed significant cost savings,[3] as did a randomized trial of home-based palliative care.[4] A recent systematic review

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demonstrated that HBMC programs are associated with reduced health service utilization, lower costs of care, better quality of life, and better patient and caregiver satisfaction. In the review, the use of an interdisciplinary team (IDT) to coordinate care for complex patients was one key factor associated with better outcomes.[5]

High-quality care coordination is more likely when the IDT has access to timely patient data at the time of care delivery.[6] Such access to up-to-date patient information is often more challenging for home-based practices than for office-based or institutional practices. This is because in HBMC, IDTs are often formed when home-based practices or providers partner with community-based organizations and disciplines that may be grounded in separate health entities and geographic locations.[7] Lack of complete health information technology interoperability between these organizations' records often means that team members from organizations partnering with a HBMC practice have more difficulty sharing health records, electronic or otherwise.

Given both the unique challenges of HBMC in care coordination and the critical role such coordination plays in HBMC effectiveness, the development of a framework for considering the quality of team-based communication and of associated quality indicators (QIs) relevant for HBMC is needed. The passage of the Medicare Access and CHIP Reauthorization Act of 2015 with its Merit-Based Incentive Payment System evaluates health care providers through their performance on quality.[8] Thus, population- and setting-appropriate QIs are vital to equip the field of HBMC to engage in value-based care. Recently, the National Home Based Primary Care and Palliative Care (NHBPCPC) Network recognized care coordination, particularly with respect to IDT access to patient information, as a critical area for the development of HBMC-specific QIs. Such QIs have not previously been represented among existing quality measures endorsed by payers, quality organizations, and professional societies.[2]

The aim of this work was to develop a framework and corresponding QIs for care coordination that address how IDT members in the HBMC setting access and share key patient information.

Methods

Systematic Literature Review

A systematic literature review was conducted to inform the development of a conceptual framework and QIs by addressing the following question: "What are the evidence base, current practices, and existing guidelines for how IDT members access and share patient information with one another in home-based medical practices?"

The search strategy was developed with the assistance of a medical librarian using variations of key MeSH terms (Appendix Figure A1) relating to the concepts of "home care services," "home care team," "adult" or "older adult," "interdisciplinary communication," and "access to information." The search strategy was applied to the following databases for the period from January 1, 1997 to February 13, 2015: PubMed, The Cumulative Index to Nursing & Allied Health, Cochrane Library, Embase, Web of Science, and Scopus databases as well as gray literature Web sites, including New York Academy of Medicine Grey Literature Report, National Library of Medicine Catalog, Google, Proquest Digital Dissertations and Theses, and guidelines/Web sites (Commonwealth Fund, Kaiser Family Foundation, California Healthcare Foundation, SCAN Foundation, National Center for Quality Assurance). Hand searches were conducted of the reference lists of retrieved articles.

Due to the dearth of literature around this aspect of care coordination in HBMC, we also considered literature from areas that could be adapted to HBMC. Studies cited in the evidence table (Appendix Table A1) were accepted for review using the following inclusion criteria: any intervention, guideline, study, or expert opinion that involves information transfer about patients' care plans between IDT members, or how IDT members or health care professionals access patient information. Because evidence-based approaches to care coordination were limited, a thematic analysis of the literature was conducted to inform development of a conceptual framework and a list of candidate QIs.

Development of Conceptual Framework on How IDT Members in HBMC Access and Communicate Patient Information

One purpose of the literature review was to inform the development of a conceptual framework (Figure 1) to describe the processes by which IDT members in HBMC access and communicate patient information. The "overall context" portion of the framework was informed by a recent survey of 272 HBMC practices.[7]

Development of Candidate QIs

Informed by the conceptual framework and the clinical experience of the investigators, we developed a preliminary list of 5 QIs. Two were patient-level QIs, in which the numerator defined the process of care to be performed on behalf of a patient and the denominator defined the eligible population. In addition to the patient-level QIs, we developed 3 practice-level QIs, which were structured as "yes" or "no" questions to ascertain whether a process recommended for optimal care coordination was being performed by an HBMC practice.

Formation of the Technical Expert Panel

We convened a Technical Expert Panel (TEP) consisting of representatives from the NHBPCPC Network to rate the candidate QIs. This Network consists of stakeholders and leaders from 12 exemplary home-based medical practices, 3 professional societies (American Academy of Home Care Medicine, American Academy of Hospice and Palliative Medicine, and American Geriatrics Society), and 3 patient advocacy groups (American Association of Retired Persons, Kaiser Family Foundation, and National Partnership for Women and Families). The TEP members prerated the candidate QIs for validity and feasibility using the RAND modified-Delphi process.[9–15] TEP members discussed the literature findings related to care coordination in home-based practices. During discussions of the merits and issues of each QI, the panel was given the option to suggest additional candidate QIs or to modify the wording of the proposed candidates before a further round of anonymous voting on the validity and feasibility of each QI. TEP members were then asked to rate feasibility of implementation of

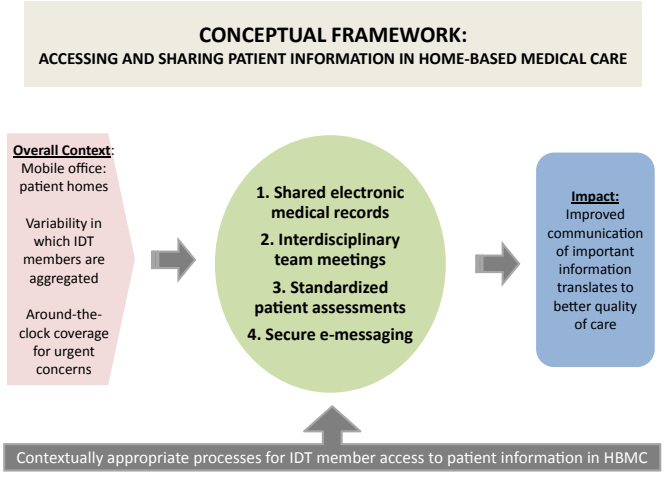

Fig. 1. Conceptual framework for how IDT members access and communicate patient information in HBMC practices.

the patient-level or practice-level QIs based on an average HBMC practice trying to deliver high-quality care and taking into consideration factors such as staffing resources, physician resources, and expense. A QI was defined as valid if (1) it was clear and explicit; (2) adequate scientific evidence or professional consensus exists to support a strong link between the performance of specified care and outcomes; (3) a provider or practice with significantly higher rates of adherence to a QI would be considered a higher-quality provider; and (4) most factors that determine adherence to a QI are under the influence of the provider or practice. A numerical score, ranging from 1 to 9, was assigned to each item for feasibility and validity, with a score of 1 representing low and a score of 9 representing high feasibility or validity. Scores of 7 or greater in both categories were considered to be valid and feasible for testing in the field.

Evaluation of TEP Ratings

Candidate QIs with a median validity and feasibility rating of 7 or higher and without disagreement were considered valid. Disagreement was defined as 2 or more panelists rating the QIs in the highest tertile (rating of 7, 8, or 9) and 2 or more ratings in the lowest tertile (rating of 1, 2, or 3).[10]

Results

Literature Review Results

The search strategy resulted in 2249 peer-reviewed publications, of which 36 articles met inclusion criteria. The gray literature search returned 4 additional relevant articles that were not already accounted for in the peer-reviewed literature. Literature search results are listed in Appendix Figure A2 and Table A1.

Conceptual Framework of IDT Member Communication

The conceptual framework on how IDT members in HBMC access and communicate patient information is depicted in Figure 1. In the framework, the overall context of HBMC practices[7] was first defined to highlight the unique challenges to accessing and sharing patient information in this setting. Next, the framework highlighted 4 process themes identified from the literature review results that represent how IDT members in the HBMC setting access and share patient information. These included use of (1) electronic medical records (EMRs), (2) IDT meetings, (3) standardized patient assessments, and (4) secure e-messaging.

The literature search identified use of EMRs[16–27] as a common tool for communicating patient information among IDT members.[28] Regular team meetings were also an important mechanism for improving IDT communication and ensuring all team members have access to key patient information. IDT members across various disciplines reported positive experiences and improved ease of interprofessional collaboration and communication between various team members due to IDT meetings.[29–33] Meetings contributed to improved patient experience, increased team efficiency, and better quality of care.[30–32,34,35] Secure e-messaging was another commonly reported mechanism for IDT members to transfer patient medical information in an expedient and concise format.[36] E-messaging led to better communication quality, better access to patient information, and improved ability to reduce errors.[37] Similarly, use of standardized patient assessment forms that were regularly updated and easily accessible to all IDT members improved communication of patient information. Such forms were particularly useful in the transfer of patients from one care setting to another[38–40] or among IDT members caring for complex patients in nursing homes,[29] HBMC,[41,42] and inpatient and outpatient palliative care teams.[43]

Development of Candidate QIs and Voting by TEP Panel

The conceptual framework informed by the literature search was used to devise a preliminary list of 2 patient-level QIs and 3 practice-level QIs. These were presented to the TEP for rating through the modified Delphi process. Based on revisions and suggestions brought forth by the TEP during the discussion, a set of 9 candidate QIs (Table 1) underwent final voting for validity and feasibility. The QIs brought forth as revisions by the TEP are italicized in Table 1. Of the 9 candidate QIs ultimately rated by the TEP, 4 met criteria for validity and feasibility. The QIs with the highest scores and thus deemed most valid and feasible for future testing in the field are bolded in Table 1. The final QIs selected for future testing are displayed in Table 2 and measure whether patients are discussed by an IDT team, whether a process exists for ongoing IDT communication, and whether standardized assessment tools facilitate IDT communication. Of note, 2 practice-level standards under the category of secure e-messaging met validity and feasibility criteria. To avoid redundancy, however, we elected only to move the standard with the lower median absolute deviation forward for further testing.

Discussion

This work aimed to address a gap in care coordination processes for HBMC by developing a framework and corresponding QIs for how IDT members may access and share patient information with one another. Using a validated approach combining systematic literature review and expert consensus by a multiprofessional panel of leaders from the NHBPCPC Network, we narrowed 9 potential QIs to 1 patient-level and 2 practice-level QIs that reflected key processes for accessing and sharing key patient information in HBMC: IDT meetings, secure e-messaging, and standardized patient assessments.

The patient-level QI measures the proportion of HBMC patients who are discussed by an IDT within a specified enrollment period. The 2 practice-level QIs examine whether HBMC practices have a process for ongoing, regular communication between team members and whether HBMC practices have patient assessments that are updated regularly and stored in a computerized database that is easy for all IDT members to access. Although the use of EMRs is clearly a key aspect of patient communication and care coordination, the investigators did not deem it suitable as a QI measure given the high proportion of home care practices with EMRs[7] and the expectation by CMS that all practices use EMRs.[7,8]

Focusing on IDT member communication is fitting, given that research repeatedly implicates communication failures as a large contributor to adverse clinical events and outcomes.[44–47] Strategies to enhance communication and teamwork, including IDT meetings, secure e-messaging, and standardized patient assessments, result in more efficient and effective communication.[29,31,36,37,42,43,48,49] Because ineffective communication among IDT members contributes to patient harm and adverse events, interventions to improve communication become instrumental in preventing negative patient outcomes.

The need for the development of interdisciplinary care plans within HBMC was emphasized in a recent workshop on the future of home health care convened by the Institute of Medicine and the National Research Council.[50] The QIs that are suggested in this article are well aligned to support this purpose as they are designed to enhance IDT communication. Furthermore, of the care coordination quality measures that are currently endorsed by the National Quality Forum, none specifically address processes for improving IDT communication and access to patient information.[51] Thus, the QIs brought forth here may help fill a gap in care coordination measures for complex care settings beyond HBMC.

Table 1
Results of TEP Voting on Validity and Feasibility of Candidate QIs

Indicator Type	Corresponding Theme	Candidate Indicators	Validity Median* (MAD)	Feasibility Median* (MAD)
Patient-level quality indicators	IDT meetings	Numerator: Number of home-based primary care and palliative care patients enrolled in the past 3 months who were discussed in an IDT† meeting at enrollment. Denominator: Number of home-based primary care and palliative care patients who have been enrolled within the past 3 months.	5.0 (1.6)	3.0 (2.1)
		Numerator: Number of home-based primary care and palliative care patients who were discussed in an IDT meeting within 1 month of a significant change in status. Denominator: Number of home-based primary care and palliative care patients who have had a significant change in status within the last month.	5.0 (1.7)	2.5 (1.6)
		Numerator: Number of home-based primary care and palliative care patients enrolled in the past 3 months who were discussed by an IDT* at enrollment. Denominator: Number of home-based primary care and palliative care patients who have been enrolled within the past 3 months.	**7.0 (1.1)**	**7.0 (1.6)**
		Numerator: Number of home-based primary care and palliative care patients who were discussed by an IDT within 1 month of a significant change in status. Denominator: Number of home-based primary care and palliative care patients who have had a significant change in status within the past month.	7.0 (0.9)	6.0 (1.0)
		Numerator: Number of home-based primary care and palliative care patients who were discussed by an IDT within 1 week of a significant change in status. Denominator: Number of home-based primary care and palliative care patients who have had a significant change in status within the last week.	8.0 (1.0)	6.0 (1.6)
Practice-level standards	Secure e-messaging	**Does the home-based primary care and/or palliative care practice have an infrastructure for secure e-messaging between team members?**	**9.0 (1.6)**	**8.0 (1.0)**
		Does the home-based primary care and/or palliative care practice have a process for ongoing, regular communication between team members?	***9.0 (1.0)***	***8.0 (0.8)***
	Standardized patient assessment	Does the home-based primary care and/or palliative care practice have a standardized patient assessment that is updated regularly and stored in a computerized database that is easily accessible to all team members?	6.0 (2.0)	7.0 (0.8)
		Does the home-based primary care and/or palliative care practice have patient assessments that are updated regularly and stored in a computerized database that is easily accessible to all team members?	***9.0 (0.4)***	***8.0 (0.8)***

MAD, median absolute deviation.
The QIs brought forth as revisions by the TEP are italicized. Of the 9 candidate QIs ultimately rated by the TEP, 4 met criteria for validity and feasibility. The QIs with the highest scores and thus deemed most valid and feasible for future testing in the field are bolded.
*Scale: 1–9.
†IDT members present at meeting must include, at minimum, the following disciplines: medical doctor/nurse practitioner/physician assistant, social work.

The typical HBMC patient is an older adult with multiple chronic conditions, functional impairments, and limited social capital.[52] Such patients need health care that is well coordinated with an array of needed long-term services and supports. Typical HBMC practices operate as mobile medical offices with the point-of-care residing in patient homes. The IDTs used by home-based practices are composed of representatives from numerous disciplines that may include physicians, nurse practitioners, administrative staff, nurses, medical assistants, case managers or care coordinators, social workers, physician assistants, licensed practical nurses, staff from other collaborating organizations, physical or occupational therapists, family members of patients, clinical pharmacists, mental health providers, aides, or nursing assistants. In many cases, the various disciplines emanate from distinct organizations or locations as opposed to the same practice. Most of these practices provide around-the clock coverage to address urgent concerns.[7]

The 4 IDT communication processes identified in Figure 1 are contextually appropriate approaches to address the challenges to information access in HBMC. Based on these processes, we developed QIs that considered the unique challenges to accessing patient information faced by IDT members in HBMC practices.

A limitation of this study was the dearth of existing literature evaluating interventions to improve the quality of care coordination for homebound older adults. Reliance on an underdeveloped evidence base means that more innovative solutions may not come to the forefront when using the modified Delphi method for QI selection. In spite of this, based on the themes derived from the literature, we were able to develop 3 QIs that can now be tested.

Table 2
Final QIs Selected for Future Testing

Indicator Type	Corresponding Theme	Selected Indicator
Patient-level quality indicator	IDT meetings	Numerator: Number of home-based primary care and palliative care patients enrolled in the past 3 months who were discussed by an IDT* at enrollment. Denominator: Number of home-based primary care and palliative care patients who have been enrolled within the past 3 months.
Practice-level standard	Secure e-messaging	Does the home-based primary care and/or palliative care practice have a process for ongoing, regular communication between team members?
Practice-level standard	Standardized patient assessment	Does the home-based primary care and/or palliative care practice have patient assessments that are updated regularly and stored in a computerized database that is easily accessible to all team members?

*IDT members present at meeting must include, at minimum, the following disciplines: medical doctor/nurse practitioner/physician assistant, social work.

To our knowledge, this is the first systematic attempt to develop a QI for how IDT members access and share patient information, both within and outside of HBMC. Use of one or more of these QIs in practice will provide opportunities to study their impact on patient care and thus move the scientific evidence behind care coordination practices forward.[2]

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Appendix

Searches run from 1997 – 2/13/2015
Filters: English, Humans
Note: First four concepts (home care services AND home care team AND adult AND communication) run together with "AND," then run again with NOT children concept.

Final PubMed search terms (refined to facilitate searches of other databases)

("home care services"[mesh] OR "home care services, hospital-based"[mesh] OR "home health nursing"[mesh] OR "home nursing"[mesh] OR "homebound persons"[mesh] OR "hospice care"[mesh] OR "house calls"[mesh] OR "palliative care"[mesh] OR "respite care"[mesh] OR "terminal care"[mesh] OR "early supported discharge"[tiab] OR "health care home"[tiab] OR "home based"[tiab] OR "home bound"[tiab] OR "home care service"[tiab] OR "home care services"[tiab] OR "home care"[tiab] OR "home health"[tiab] OR "home nursing"[tiab] OR "home visit"[tiab] OR "home visits"[tiab] OR "homebound"[tiab] OR "hospice care"[tiab] OR "hospice"[tiab] OR "hospices"[tiab] OR "house bound"[tiab] OR "house call"[tiab] OR "house calls"[tiab] OR "house care"[tiab] OR "housebound"[tiab] OR "housecare"[tiab] OR "long term service"[tiab] OR "long term services"[tiab] OR "palliative care"[tiab] OR "patient centered"[tiab] OR "respite care"[tiab] OR "terminal care"[tiab]) AND ("home care team"[tiab] OR "home care teams"[tiab] OR "homecare team"[tiab] OR "homecare teams"[tiab] OR "patient care team"[mesh] OR "patient care teams"[tiab] OR "home care group"[tiab] OR "home care groups"[tiab] OR "home"[tiab] OR "homes"[tiab] OR "house"[tiab] OR "houses"[tiab] AND (member*[tiab] OR group*[tiab] OR provider*[tiab] OR team*[tiab])) AND ("adult"[mesh] OR "adults"[tiab] OR "adult"[tiab] OR "aged"[mesh] OR "elderly"[tiab] OR "aged, 80 AND over"[mesh] OR "oldest old"[tiab] OR "nonagenarians"[tiab] OR "nonagenarian"[tiab] OR "octogenarians"[tiab] OR "octogenarian"[tiab] OR "centenarians"[tiab] OR "centenarian"[tiab] OR "frail elderly"[mesh] OR "frail elders"[tiab] OR "frail elder"[tiab] OR "functionally-impaired elderly"[tiab] OR "functionally impaired elderly"[tiab] OR "frail older adults"[tiab] OR "frail older adult"[tiab] OR "middle aged"[mesh] OR "middle aged"[tiab] OR "middle age"[tiab]) AND ("communication"[mesh] OR "interdisciplinary communication"[mesh] OR "access to information"[mesh] OR "access to information"[tiab] OR "information access"[tiab] OR "interdisciplinary communication"[tiab] OR "health communication"[mesh] OR "health communication"[tiab] OR "health communications"[tiab] OR "communication"[tiab] OR "communications"[tiab] OR "misinformation"[tiab]) NOT ("child"[mesh] OR "adolescent"[mesh] OR "pediatrics"[mesh] OR "young adult"[mesh] OR "child health services"[mesh] OR "infant"[mesh] OR "child development"[mesh] OR "child, preschool"[mesh] OR "pediatric"[ti] OR "paediatric"[ti])

Fig. A1. Systematic review search terms.

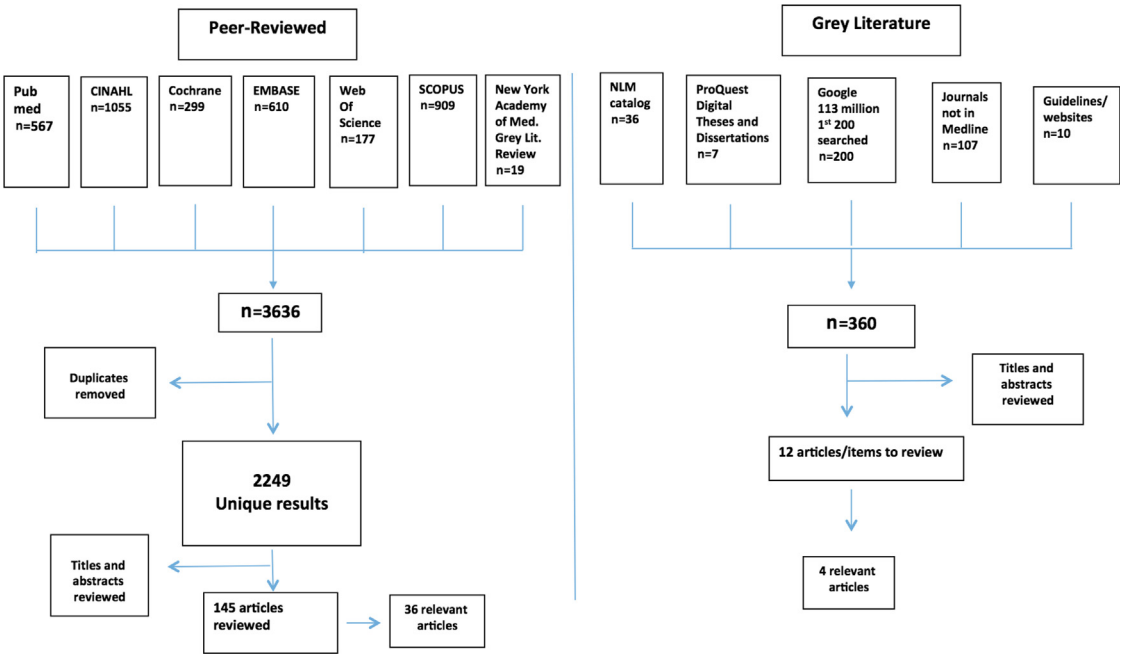

Fig. A2. Flow diagram outlining results from literature search.

Table A1
Results From Literature Search

Author, y, Reference	Objective	Study Design or Report Type	Population/Context	Findings to Inform Theme
IDT meetings				
Badger et al, 2012[1]	Describe impact of Gold Standards Framework in Care Homes (GSFCH) program on collaboration between nursing home (NH) staff and other professionals.	(1) Pre- and post-program surveys and (2) Case studies in a small sample of homes	Managers, staff, residents, and family members related to NHs in England that participated in GSFCH program	Developed regular meetings between specialists and NH staff: support is now freely available in contrast to former reactive system when it had to be actively sought. Now had a specific person available to call. Improved communication linked to improved NH staff confidence.
Bijma et al, 2007[2]	Evaluate impact of IDT discussions on decision-making about management of unborn infants.	Prospective analysis of 78 cases discussed by IDT	Perinatal team at tertiary center caring for unborn infants with serious anomalies	15% increase in consensus about management of unborn infants supports improved decision-making resulting from team meetings.
Boorsma et al, 2011[3]	Compared impact of multidisciplinary integrated care intervention vs usual care on quality of care. Intervention: geriatric functional assessment every 3 mo, design of individualized care plan, discussion of outcomes and care priorities with general practitioner (GP)/resident/family, monthly multidisciplinary team meetings.	Cluster randomized controlled trial	Ten residential care facilities in the Netherlands; 340 elderly residents with physical or cognitive disabilities 5 applied intervention, 5 usual care	Intervention facilities had significantly higher sum score of 32 quality of care indicators and significantly higher scores for 11 of 32 indicators of good care in areas of communication, delirium, behavior, continence, pain, and antipsychotic use.
Boxer et al, 2011[4]	Evaluate impact of discussion at a lung cancer IDT meeting on patterns of care.	Cohort study	908 patients newly diagnosed lung cancer in Southwest Sydney identified from local cancer registry; 504 presented at IDT meetings; 484 not presented at IDT meetings	IDT meeting associated with increased receipt of chemotherapy, radiotherapy, and palliative care referral (increased treatment receipt may improve quality of life) but not with improved survival.
Copeland et al, 2013[5]	Examine trainee perceptions of the role of "huddles" or team meetings in team-based primary care and their impact on provider and patient experience.	Qualitative study; semistructured interviews	Nineteen trainees (internal medicine residents and nurse practitioner students) at San Francisco VA and University of California San Francisco	Trainees reported: huddle is the primary event for interprofessional collaboration; huddles improved primary care experience for providers and patients; increased team efficiency; better care for patients.
Delgado et al, 2009[6]	Assess feasibility of establishing IDT family meeting program and the impact of program on end-of-life decision-making in the intensive care unit (ICU).	Pilot study; Meetings followed a structured format; pertinent details of meetings and treatment goals were recorded	Tertiary-care center medical ICU patients who required mechanical ventilation for 5 days or more	All meetings addressed patients' diagnosis, prognosis, and goals of care. Pain and spiritual issues were discussed when a palliative care team member was present. Favorable feedback from all designated family spokespersons—reported better understanding of relative's medical condition and arrival to meaningful treatment plan with little family conflict. Positive feedback from ICU nurses and physicians: productive, enlightening, and educational.
Farris et al, 2004[7]	Evaluate impact of collaborative primary health care team (PHCT) program involving 1.5-h weekly IDT meetings on health status and medication use of high-risk community-dwelling patients.	Single group pre-post design	Six PHCTs consisting of GP, nurse, pharmacist, and home care case manager from community-based clinics in Canada	Medication adherence and physical health improved at 3 and 6 months. Decreasing trends in GP visits, emergency department visits, and hospital admissions.

Frock and Barnes, 2003[8]	To describe the model home care team as envisioned by the authors.			Recommends that IDTs meet as frequently as daily to weekly to coordinate patient care; meeting facilitated by a case manager.
Meyer, 2011[9]	Describing a virtual ACE (Acute Care for Elders) model.	Quality improvement intervention	Hospital in Aurora, Wisconsin	Intervention: Used data from EMR to create a computerized spreadsheet with a list of all older patients in hospital with their risk factors for functional decline or poor outcomes. Report is produced automatically on each older patient daily, updated every 15 minutes. IDT met daily to go over ACE tracker report for each older patient and develop an appropriate plan. Geriatrician from another facility began participating in meetings by teleconference twice a week. Results: decreased percentage of patients receiving urinary catheters from 26.2% to 20.1%; increased use of interdisciplinary services like physical therapy and social work.
Morrison and Sanders, 2011[10]	Describes concept of "huddle" and how it can be successfully implemented onto a 34-bed surgical unit.	Implementation study	Albert Einstein Medical Center	Describes team "huddles" as a way to improve effectiveness of communication among members of IDT. Provides case-based examples of how huddles have led to improved patient care. Huddling intervention resulted in decreased catheter-associated urinary tract infection, central line–associated blood stream infections, and patient falls.
Schols and de Veer, 2005[11]	Provide insight into type of medical information exchanged between GPs and NH physicians at time of NH admission and discharge.	Cross-sectional survey	A total of 780 GPs in the Netherlands	More information exchanged when GPs had more frequent personal contact with NH physicians at both admission and discharge.
Smith-Carrier and Neysmith, 2014[12]	Identify key attributes for interprofessional working within a home-based primary care setting.	Case study involving interviews, participant observation, and a survey	Canadian IDT home-based primary care team serving frail elderly clients (all older than 65, most older than 80) who are homebound and have multiple chronic conditions	Participants indicated a need for regular team meetings, stating that the use of the EMR, although vital, could not replace opportunities for face-to-face interaction.
Vanderboom et al, 2013[13]	Describe the development of the Community Connections Program (CCP), a short-term intensive, team-based service planning and care coordination program for older adults with multiple chronic health conditions.	Implementation study	Mainly white women, mean age 77 with multiple chronic conditions in a PCMH	Intervention involved team meetings at baseline, at 3 mo, and with status changes. Involved developing and initiating a comprehensive care plan that was shared with care providers, patients, and caregivers. Care coordination and self-management support as measured by Patient Assessment of Chronic Illness Care was rated at 100% for care coordination and integration by patients' identified support persons.

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Table A1 (*continued*)

Author, y, Reference	Objective	Study Design or Report Type	Population/Context	Findings to Inform Theme
Secure e-messaging between team members				
Feldman et al, 2005[14]	Test effectiveness of e-mail reminders on adoption of evidence-based practice by home health nurses caring for heart failure patients.	Randomized design	Nurses serving patients enrolled at a large, urban, nonprofit home health agency	E-mail reminders resulted in greatly increased practice of evidence-based care in areas of patient assessment and heart failure management.
Green et al, 2008[15]	Determine if a model of care using patient Web services, home blood pressure monitoring, and pharmacist-assisted care improves BP control.	Randomized controlled trial	A total of 778 patients aged 25 to 75 from integrated group practice in Washington state with uncontrolled essential hypertension and Internet access	Pharmacist care management delivered through secure patient and physician Web communications improved BP control in patients with hypertension.
Lyngstad and Hellesø, 2014[16]	Investigate experiences of home health care nurses and GPs using e-messaging in their communication.	Cross-sectional questionnaire	A total of 584 home health nurses and GPs who used e-messaging and 495 home-health care nurses and GPs who did not use e-messaging in Norway	High agreement between all groups that e-messaging led to better communication quality, better access to patient information, and improved ability to reduce errors and omissions.
McDonald et al, 2005[17]	Test the effectiveness of 2 nurse-targeted e-mail–based interventions to increase home care nurses' adherence to pain assessment and management guidelines, and to improve patient outcomes.	Randomized design	Home health nurses working for a large, certified, nonprofit, urban home health agency and the patients they served (18 or older with a diagnosis of cancer) and self-reported frequency of daily or constant pain at admission	Reduced pain intensity in intervention group.
Robben et al, 2012[18]	Describe process evaluation of implementation of a shared EMR combined with a communication tool for community-dwelling older adults and primary care providers (PCPs).	Mixed methods study	A total of 290 frail older adults and 169 PCPs in the Netherlands	Easy to use for professionals, but less uptake than expected by frail elders. Barriers included low computer literacy of patients and a preference for personal communication.
Ruggiano et al, 2012[19]	Explore the current state of interprovider communication between home care case managers (HCCMs) and physicians and HCCMs' perceptions of the potential use and benefits of a Web-based information technology (IT) intervention aimed at improving communication and information sharing with their clients' physicians.	Survey	Seventy case managers working in Medicaid-waiver home and community-based service programs at 2 home care agencies in Southeast Florida	Recommended that an IT Web-based platform for the purpose of communicating a variety of patient information to physicians within the context of HCCM would improve the frequency and quality of home care communication by allowing case managers and physicians to transfer patient medical information in an expedient and concise format.
Vanderboom et al, 2013[13]	Describe the development of the Community Connections Program (CCP), a short-term intensive, team-based service planning and care coordination program for older adults with multiple chronic health conditions.	Implementation study	Mainly white women, mean age 77 with multiple chronic conditions in a PCMH	Intervention involved team meetings at baseline, at 3 mo, and with status changes. Involved developing and initiating a comprehensive care plan that was shared with care providers, patients, and caregivers. Care coordination and self-management support as measured by Patient Assessment of Chronic Illness Care was rated at 100% for care coordination and integration by patients' identified support persons.
O'Malley et al, 2015[20]	Identify how EMRs facilitate and pose challenges to primary care teams as well as how practices are overcoming these challenges.	Qualitative	Sixty-three respondents from patient-centered medical homes ranging from physicians to front-desk staff, from 27 primary care practices ranging in size, type, geography, and population size	EMRs were found to facilitate communication and task delegation in primary care teams through instant messaging, task management software, and the ability to create evidence-based templates for symptom-specific data collection from patients by medical assistants and nurses (which can offload work from physicians).

Standardized patient assessment				
Anderson and Helms, 1998[21]	Describe and compare continuing care communication between hospitals and NH or home health agencies (HHAs).	Retrospective, descriptive design using convenience samples	Newly discharged elderly (>65 y) patients; 455 referred to NH; 300 referred to HHA	Transfer of data using standardized forms compared with no form or telephone call resulted in transfer of more patient information.
Badger et al, 2012[1]	Describe impact of GSFCH program on collaboration between NH staff and other professionals.	(1) Pre- and post-program surveys and (2) Case studies in a small sample of homes	Managers, staff, residents, and family members related to NHs in England that participated in GSFCH program	Increased use of out-of-hours forms to provide GPs and other collaborators with structured information about residents; improved communications with out-of-hours services. Improved communication linked to improved NH staff confidence.
Cumming et al, 2010[22]	Develop a process to improve flow of information from inpatient to outpatient care for adult patients with cystic fibrosis (CF).	Stakeholder meeting to determine components of a "Hospital to Home Worksheet"	Patients with CF who are cared for at Baylor College of Medicine Adult CF Center who are discharged from hospital	Information regarding hospitalization and discharge is transmitted from inpatient to outpatient and incorporated into EMR, thereby facilitating complete follow-up care.
Gum et al, 2014[23]	Pilot test an IDT communication protocol among home-based providers delivering depression care management.	Pilot trial of BRIDGE (Bridging Inter-Disciplinary Guidelines to Elders)	Seven homebound adults aged 62−83 y with depression	BRIDGE protocol that included tailored communication procedures and standardized progress reports sent from home-based providers to primary care practices resulted in improved disability depressive symptoms in patients.
Guthrie et al, 2014[24]	Examine feasibility of sharing data from RAI-HC (Resident Assessment for Home Care) between care coordinators and providers.	Pilot test with focus groups	Focus groups involved care coordinators and home care providers for "long-stay" home care patients age 55+	Focus group participants determined what information would be shared between care coordinators and providers in a standardized format. Participants suggested data sharing could be improved with an electronic form that is accessible by multiple professionals. Data sharing led to increased communication between care coordinators and providers.
Lilja et al, 2000[25]	Describe and evaluate a clinical attempt to change occupational therapy practice when reporting on geriatric clients between occupational therapists (OTs); identify and describe aspects that influence the transfer of information.	Case study: planning and implementation of a procedure for transferring information about geriatric clients of OTs	Four levels of care in Sweden: 4 hospital geriatric wards, primary health care clinic with OTs working at clinics or in home setting, community settings with OTs working in social services or clients homes, nursing homes	Used a uniform instrument of communication to transfer information about activities of daily living.
Walsh and Zhukovsky, 2004[26]	Develop and pilot test a 1-page, structured problem list to facilitate communication of complex patient information in palliative medicine.	Descriptive study	Inpatient and outpatient palliative care referrals at Cleveland Clinic	Problem list seen as a mechanism to facilitate interdisciplinary and multidisciplinary communication and continuity of care in the hospital and in the community. Authors believe this problem list facilitates succinct communication of complex patient information essential to optimal patient care.

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Table A1 (*continued*)

Author, y, Reference	Objective	Study Design or Report Type	Population/Context	Findings to Inform Theme
O'Malley et al, 2015[20]	Identify how EMRs facilitate and pose challenges to primary care teams as well as how practices are overcoming these challenges.	Qualitative	Sixty-three respondents from patient-centered medical homes ranging from physicians to front-desk staff, from 27 primary care practices ranging in size, type, geography, and population size	EMRs were found to facilitate communication and task delegation in primary care teams through instant messaging, task management software, and the ability to create evidence-based templates for symptom-specific data collection from patients by medical assistants and nurses (who can offload work from physicians).
Sabogal, 2007[27]	To educate NH professionals about appropriate handoffs between medical providers.	Evidence-based guidelines by California HealthCare Foundation on coordinating care transitions	Target audience: NH professionals	Recommendation to prepare standardized written and oral instructions to pass instructions off to next provider with administrative data, patient background, up-to-date clinical information, current conditions, etc.
Use of electronic medical record				
Fairchild et al, 2002[28]	To assess communication between ambulatory physicians and home care nurses within 1 primary care network.	Mail survey	Sixty-seven ambulatory physicians from 1 academic medical center—affiliated primary care network and 820 home care nurses from 8 regional home care agencies	Eighty percent of ambulatory physicians and 90% of home care nurses felt that access to a common EMR and the ability to communicate by e-mail would be extremely or moderately useful.
Meyer, 2011[9]	Describing a virtual ACE model.	Quality improvement intervention	Hospital in Aurora, Wisconsin	Intervention: Used data from EMR to create a computerized spreadsheet with a list of all older patients in hospital with their risk factors for functional decline or poor outcomes. Report is produced automatically on each older patient daily, updated every 15 min. IDT met daily to go over ACE tracker report for each older patient and develop an appropriate plan. Geriatrician from another facility began participating in meetings by teleconference twice a week. Results: decreased percentage of patients receiving urinary catheters from 26.2% to 20.1%; increased use of interdisciplinary services like physical therapy and social work.
Ervin and Berry, 2006[29]	Prepare for development of grant application to fund information network for facilitating timely and efficient delivery of long-term care services.	Descriptive study using focus groups	Twenty-eight individuals over 5 sessions, including attorneys, physicians, and members of a home health care coalition	Physicians believed a secure computer system networked among all agencies would be useful to share information across different health care settings.
Harris et al, 2011[30]	Illustrate the importance of out-of-hours providers having adequate access to patient information.	Clinical vignette		Due to lack of literature discussing this need, author used vignette to demonstrate that access to an EMR is key to safe and effective patient care.

Heimly, 2008[31]	Describe a project for consent-based access to a municipal EMR.	Project description	Norway	Description of consent-based municipal EMR that is being launched in Norway to increase prescriber access to patient information with the idea that this should become a national standard. Additionally involves sharing of individual care plans, electronic message exchange for better cooperation between care sites, and secure e-mail infrastructure.
Koch et al, 2004,[32] 2003[33]	Describe the development of an EMR for HBMC.	Project description	Elderly homebound patients in Sweden	Project aimed at developing the correct infrastructure to provide seamless and consistent information flow between providers.
Massy-Westropp et al, 2005[34]	Pilot effectiveness of electronic data linking tools to assist in transfer of information between hospital and HBMC provider.	Mixed-methods	Fifty-five physicians from an Australian home care organization and public university teaching hospital	Electronic data linking system was effective in reducing labor costs (staff time saving of 20%, ~ $12,000), increasing organizational communication, and devising appropriate discharge plans. Home care staff felt better informed about patients' health and functional status and were able to take a more active role in their care.
Ornstein et al, 2011[35]	Evaluate pilot of an NP-led transitional care program designed to improve coordination and continuity of care, reduce readmissions, garner positive provider feedback, and demonstrate financial benefits.	Mixed-methods	A total of 1464 hospitalized homebound patients enrolled in Mt Sinai's home-based medical program; average age 82	Intervention heavily relied on EMR documentation. Findings: Improved communication between home-based primary care providers and inpatient providers of all disciplines; facilitated timely and accurate transfer of critical patient information; did not decrease hospital length of stay or readmission rate.
Robben et al, 2012[18]	Describe process evaluation of implementation of a shared EMR combined with a communication tool for community-dwelling older adults and PCPs.	Mixed methods study	A total of 290 frail older adults and 169 PCPs in the Netherlands	Easy to use for professionals, but less uptake than expected by frail elders. Barriers included low computer literacy of patients and a preference for personal communication.
Ruggiano et al, 2012[19]	Explore the current state of interprovider communication between HCCMs and physicians and HCCMs' perceptions of the potential use and benefits of a Web-based IT intervention aimed at improving communication and information sharing with their clients' physicians.	Survey	Seventy case managers working in Medicaid-waiver home and community-based service programs at 2 home care agencies in Southeast Florida	Recommended that an IT Web-based platform for the purpose of communicating a variety of patient information to physicians within the context of HCCM would improve the frequency and quality of home care communication by allowing case managers and physicians to transfer patient medical information in an expedient and concise format.
Landers et al, 2007[36]	Identify process QIs that are essential to high-quality, home-based primary care.	Review of established QIs for applicability to home-based primary care	Two national expert panels whose members varied in practice type, location, and setting	All 14 continuity and coordination of care measures involve documentation in medical record.
Sockolow et al, 2014[37]	Identify barriers and facilitators to EMR adoption in a Medicare-certified skilled home-care agency.	Mixed-methods	Clinicians in home care agency	EMR facilitated team communication, similarly to in-person communication (but limited when team member does not have access to a laptop); EMR facilitated dialogues with patients about previous visits.

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Table A1 (*continued*)

Author, y, Reference	Objective	Study Design or Report Type	Population/Context	Findings to Inform Theme
Page et al, 2012[38]	Describe the development of a health technology dashboard designed to improve care coordination in hospital to home transitions.	Description of dashboard	Plan to conduct future usability and feasibility studies with home health care agencies, physicians, case managers, patients, caregivers	Relevant goals are to increase and enhance how physicians monitor the status of their patients receiving home and community-based services and how they communicate and exchange patient information with case managers. Dashboard is a working prototype at the time of this publication.
Vimarlund et al, 2008[39]	Pilot test an information and communications technology tool in an elderly home-care setting.	Qualitative	Swedish health care professionals who conduct home visits	Participants reported enhance communication between care providers across organizations and increased work efficiency.
O'Malley et al, 2015[20]	Identify how EMRs facilitate and pose challenges to primary care teams as well as how practices are overcoming these challenges.	Qualitative	Sixty-three respondents from patient-centered medical homes ranging from physicians to front-desk staff, from 27 primary care practices ranging in size, type, geography, and population size	EMRs were found to facilitate communication and task delegation in primary care teams through instant messaging, task management software, and the ability to create evidence-based templates for symptom-specific data collection from patients by medical assistants and nurses (which can offload work from physicians).
Giovanna et al, 2012[40]	Guidelines from the California HealthCare Foundation and the California Quality Collaborative on improving and implementing a complex care management program for medically, functionally, and psychologically complex patients.	Guidelines	N/A	Recommended virtual or in-person multidisciplinary case conferences to facilitate communication among all providers caring for a patient.

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