Evidence Report/Technology Assessment
Number 202

Transition of Care for Acute Stroke and Myocardial Infarction Patients:

From Hospitalization to Rehabilitation, Recovery, and Secondary Prevention

Executive Summary

Background

The Centers for Medicare & Medicaid Services (www.cms.gov), the National Quality Forum (www.qualityforum.org), and the Institute of Medicine (www.iom.edu) have identified improved transitions in care as priorities for demonstration projects and research to reduce rehospitalizations and improve the quality of postdischarge care.

Despite advances in the quality of acute-care management of stroke and myocardial infarction (MI), there are gaps in knowledge about effective interventions to better manage the transition of care for patients with these complex health conditions. Transition of care is defined as "a set of actions designed to ensure the coordination and continuity of health care as patients transfer between different locations or different levels of care within the same location,"[1] and is often provided by interdisciplinary teams of professionals.[2] Indicators of potential transition problems include avoidable rehospitalizations and emergency room visits as well as poor functional status and quality of life.

The Centers for Disease Control and Prevention (CDC) requested that the Agency for Healthcare Research and Quality's (AHRQ's) Evidence-based Practice Center Program systematically review the evidence for transition of care services and programs that improve the posthospitalization quality of care for individuals who have experienced strokes or

Evidence-based Practice Program

The Agency for Healthcare Research and Quality (AHRQ), through its Evidence-based Practice Centers (EPCs), sponsors the development of evidence reports and technology assessments to assist public- and private-sector organizations in their efforts to improve the quality of health care in the United States. The reports and assessments provide organizations with comprehensive, science-based information on common, costly medical conditions and new health care technologies. The EPCs systematically review the relevant scientific literature on topics assigned to them by AHRQ and conduct additional analyses when appropriate prior to developing their reports and assessments.

AHRQ expects that the EPC evidence reports and technology assessments will inform individual health plans, providers, and purchasers as well as the health care system as a whole by providing important information to help improve health care quality.

The full report and this summary are available at www.ahrq.gov/clinic/epcix.htm.

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Evidence-Based Practice

MIs. The results of this review will inform the CDC about the current strength of evidence as it develops future initiatives (e.g., research, clinical, public health, and policy) to implement evidence-based recommendations for stroke and MI systems of care and postacute quality-of-care programs.

The median risk-standardized 30-day readmission rate for acute MI is approximately 20 percent.[3] Stroke patients are also at high risk for hospital readmissions, with 30 percent of acute stroke patients experiencing at least one readmission within 90 days after discharge.[4] Acute-care hospitalization is a "point of influence" to improve outcomes and quality of care for recovery, risk-factor management, and better health. Better management of patients' care will require management across multiple providers and settings. It will soon be expected that acute-care settings accept the responsibility to manage care transitions and avoid rehospitalizations. In 2012, the Patient Protection and Affordable Care Act will financially penalize hospitals for high readmission rates. In 2015, acute MI will be one of the conditions targeted for improved quality of care, and stroke may be a condition identified in the future. These policies will increase the incentives for acute-care hospitals to develop effective transition of care programs and support integrated care. It will be important for health systems to develop and implement sustainable transition of care models in collaboration with primary care, other postacute health care systems (e.g., home health, rehabilitation centers, skilled nursing facilities), community-based services, and patients and their families.

Patients recovering from acute MI or stroke have complex medical and social needs and, as such, effective interventions are required to manage the transition of care from the acute hospital setting to one based in the community. This suggests that a broad and multidisciplinary review is required to adequately explore the key questions of transition of care for patients diagnosed with stroke or MI.

Objectives

The goal of this evidence report was to review the literature that explores opportunities and limitations of existing models (such as patient resource management) available for patients as they navigate from acute hospital care to rehabilitation services and eventually to independent or dependent living. We reviewed the available published literature to assess whether evidence exists that coordinated transition of care services for postacute management have a beneficial effect on patient outcomes, processes of care, or health care utilization.

The Key Questions (KQ) considered in this systematic review were:

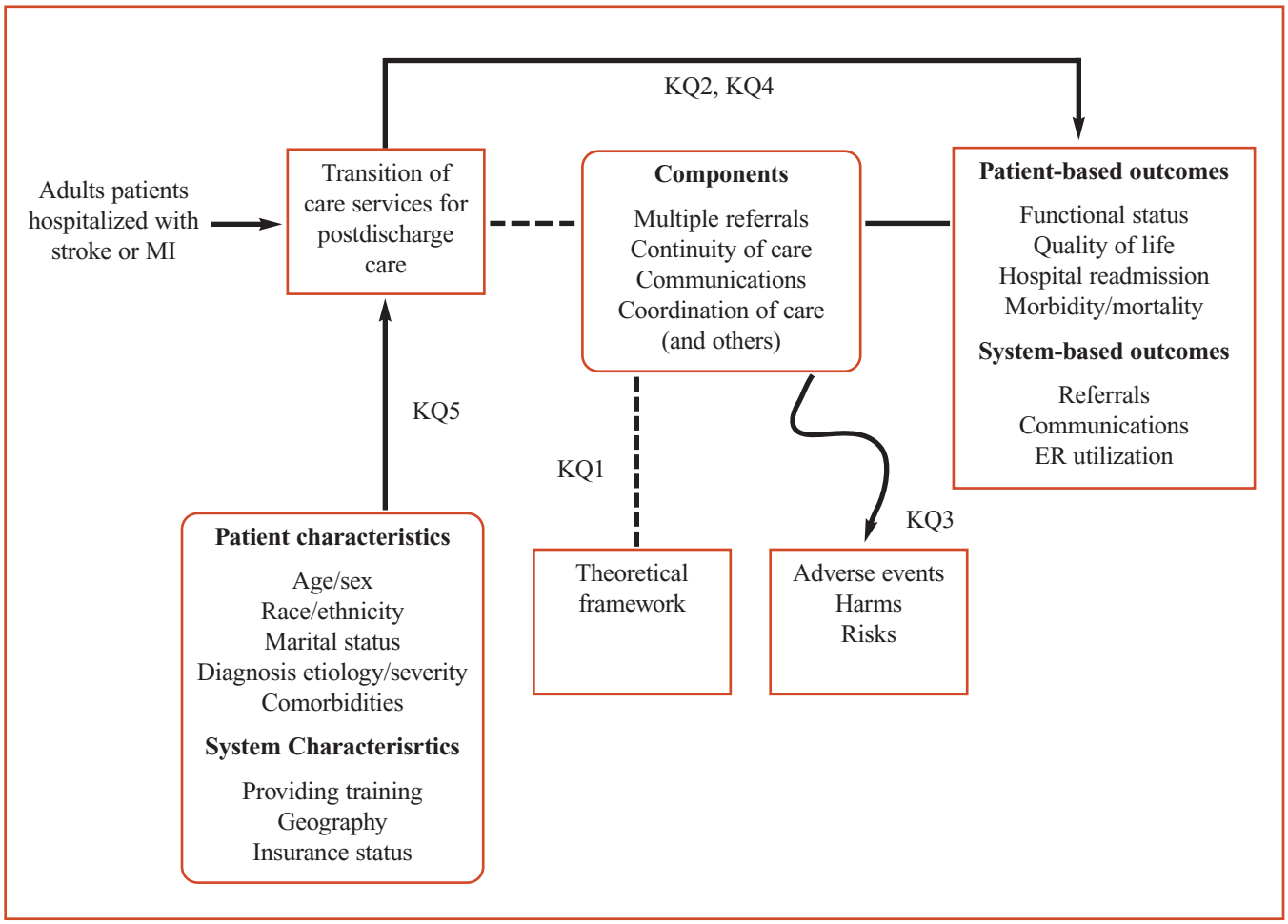
- **KQ 1**. For patients hospitalized with first or recurrent stroke or MI, what are the key components of transition of care services? Can these components be grouped in a taxonomy, and are they based on a particular theory?
- **KQ 2**. For patients hospitalized with first or recurrent stroke or MI, do transition of care services improve functional status and quality of life and reduce hospital readmission, morbidity, and mortality (up to 1 year postevent)?
- **KQ 3**. For patients hospitalized with first or recurrent stroke or MI, what are the associated risks, adverse events, or potential harms—both system-based and patient-based—of transition of care services?
- **KQ 4**. Do transition of care services improve aspects of systems of care for patients with stroke or MI (e.g., more efficient referrals, more timely appointments, better provider communication, reduced use of urgent care, or fewer emergency room visits as a result of transition of care services)? Is there improved coordination among multiple subspecialty care providers, and are new providers added to the care plan as a result of transition of care services?
- **KQ 5**. For patients hospitalized with first or recurrent stroke or MI, do benefits and harms of transition of care services vary by characteristics—both patient-based and system-based—such as disease etiology and severity, comorbidities, sociodemographic factors, training of the health care providers, participants (patients, caregivers), geography (rural/urban, regional variations), and insurance status?

Analytic Framework

The analytic framework (Figure A) shows how the components of transition of care services (e.g., multiple referrals, continuity and coordination of care, communication) for the postdischarge care of adult patients hospitalized with stroke or MI result in both patient-based and system-based outcomes (e.g., functional status, quality of life, hospital readmission, morbidity, and mortality). In

addition, the components of transition of care services are analyzed by both patient-based and system-based characteristics as well as within the context of a theoretical framework. Adverse events, associated risks, or potential harms of transition of care services (both system-based and patient-based) are also addressed.

Figure A. Analytic framework



Abbreviations: ER = emergency room; KQ = Key Question; MI = myocardial infarction
Note: "Multiple referrals" indicates referrals to primary care and other health care providers.

Methods

1. **Input from Stakeholders**. We identified experts in the field of transition of care services for patients with stroke and MI to serve as members of the project's Technical Expert Panel (TEP). The TEP contributes to AHRQ's broader goals of (1) creating and maintaining science partnerships and public–private partnerships and (2) meeting the needs of an array of potential customers and users of this report. To ensure accountability and scientifically relevant work, we asked the TEP for input at key stages of the project. More specifically, TEP members participated in conference calls and email exchanges to refine the analytic framework and key questions at the beginning of the project, refine the scope, discuss inclusion and exclusion criteria, and provide input on methodology. An additional group of peer reviewers was identified to provide comments on the report. Peer reviewers differed from the TEP members in that they were not involved during the development phase of the project. The report was also posted for public comment. A summary and disposition of the comments from peer and public reviewers has been prepared and submitted to AHRQ.

2. **Data Sources and Selection**. The comprehensive literature search included electronic searching of peer-reviewed literature databases from January 1, 2000, to April 21, 2011. These databases included the Cumulative Index to Nursing and Allied Health Literature (CINAHL®), MEDLINE® accessed via PubMed®, Cochrane Database of Systematic Reviews, and Embase®. Searches of these databases were supplemented with manual searching of reference lists contained in all included articles and in relevant review articles. Search strategies were specific to each database in order to retrieve the articles most relevant to the key questions. Our basic search strategy used the National Library of Medicine's Medical Subject Headings (MeSH) keyword nomenclature developed for MEDLINE, limited to articles published in English, and a manual search of retrieved articles and published reviews. Search terms and strategies were developed in consultation with a medical librarian.

Table A shows the inclusion and exclusion criteria for the KQs.

Table A. Inclusion and exclusion criteria

Category	Criteria
Study population	KQs 1–5: • Adults ≥ 18 years old who were discharged, or were preparing to be discharged, from a hospital for the following two conditions: ◆ Acute myocardial infarction (ST elevation myocardial infarction or non-ST elevation myocardial infarction) was defined by clinical signs or symptoms consistent with an acute coronary syndrome in addition to documented electrocardiographic or enzyme evidence of myocardial ischemia or injury. Patients with unstable angina were also included if evidence of ischemia was present. • Stroke (acute ischemic stroke or intracerebral hemorrhage) was defined as a focal neurologic deficit lasting more than 24 hours attributed to a cerebral vascular cause (either acute ischemic stroke or intracerebral hemorrhage). • Studies reporting mixed populations of discharge diagnoses were included if the results for the myocardial infarction or stroke population were reported separately.

Table A. Inclusion and exclusion criteria (continued)	
Category	**Criteria**
Study population (continued)	• Studies focused solely on patients with transient ischemic attack, subarachnoid hemorrhage, noncardiac chest pain, or congestive heart failure without myocardial infarction were excluded.
Study design	KQs 1–5: • Original data published since 2000[a] • Randomized controlled trials • Prospective or retrospective observational studies • Registries • Excluded if case report, editorial, letter to the editor, or pilot/exploratory study with small sample size and not powered to detect a statistically meaningful result as stated by the authors
Interventions	KQs 1¬5: Components of transition of care services (peridischarge) included: • Case management to oversee all care across multiple care environments (acute care, intermediate care, home health care, and community settings) • Discharge planning including procurement of equipment and services, referrals for followup care (e.g., home health care, social services, rehabilitation), and education about community resources • Self-management tools to alleviate patient and caregiver burden associated with managing transitions between care environments • Care pathways developed to organize treatment and rehabilitation across care settings • Systems for shared access to patient information to allow multiple health care providers across settings to access patient information and to coordinate care • Referrals to specialty care providers (e.g., cardiologist, neurologist) based on patient needs, included as part of the transition of care service • Referral back to primary care providers included as part of the transition of care service
Comparator	KQs 1–5: Usual care—defined as care that did not include transition of care services that coordinated care among multiple providers (e.g., a simple recommendation for followup with primary care and other health care providers, or direct discharge to home or other health care facility)

Table A. Inclusion and exclusion criteria (continued)	
Category	**Criteria**
Study outcomes	• KQs 2, 3, and 4: Outcomes included death, hospital readmission, return to premorbid status, functional ability, quality of life, and hospital-free days. Predictors of these outcomes included the following: ◆ System-level of analysis: Academic versus community hospital, specialist versus general health care provider, urban versus rural setting ◆ Patient-level of analysis: Race, ethnicity, sex, comorbidities, socioeconomic and insurance status • KQ 3: Outcomes included adverse events/harms/risks (e.g., readmissions, delayed discharge, increased utilization with no improved clinical outcomes, increased patient/caregiver burden, dropped from insurance) • KQs 4 and 5: Outcomes included continuity of health care (with specialist and general health care provider), or the total number of health care providers/services for a patient
Timing	KQs 1–5: Any time period (up to 1 year) following a hospital discharge from an acute myocardial infarction or stroke
Settings	KQs 1–5: • Setting at baseline was an acute-care hospitalization • Posthospitalization care setting included inpatient (e.g., inpatient rehabilitation facility, skilled nursing facility), outpatient (primary care physician, rehabilitation), and home care (including home modifications if needed) • Geographical location, number of sites
Publication languages	English only

[a]The TEP approved a literature start date of 2000 because this date provided the most current publications and emphasized the current paradigms of care.
Abbreviation: KQ = Key Question

Interventions solely comprising cardiac rehabilitation or stroke rehabilitation were excluded since both are services that can be prescribed independently from a transition of care program. These articles were excluded at the full-text screening stage in the category of "not a system-level transitional intervention." We did not identify any transition of care interventions that were developed to support patients transitioning from hospital to rehabilitation (either cardiac or stroke) or from rehabilitation to home.

Using the prespecified inclusion and exclusion criteria, titles and abstracts were examined independently by two reviewers for potential relevance to the key questions. Articles included by any reviewer underwent full-text screening. At the full-text screening stage, two independent reviewers read each article to determine if it met eligibility criteria. At the full-text review stage, paired researchers independently reviewed the articles and indicated a decision to "include" or "exclude" the article for data abstraction. When the paired reviewers arrived at different decisions about whether to include or exclude an article, they reconciled the difference

through a third-party arbitrator. Articles meeting our eligibility criteria were included for data abstraction.

3. **Data Extraction and Quality Assessment**. Data from included reports were abstracted into the database by one reviewer and read by a second reviewer. Data elements abstracted included descriptors to assess applicability, quality elements, intervention details, and outcomes. Disagreements were resolved by consensus or by obtaining a third reviewer's opinion when consensus could not be reached.

We employed internal and external quality-monitoring checks through every phase of the project to reduce bias, enhance consistency, and verify accuracy. Examples of internal monitoring procedures were two progressively stricter screening opportunities for each article (abstract screening, full-text screening, and data abstraction), involvement of two individuals in each data abstraction, and agreement of the two investigators on all included studies. The peer review process was our principal external quality-monitoring device.

The included studies were assessed on the basis of the quality of their reporting of relevant data. We evaluated the quality of individual studies using the approach described in AHRQ's Methods Guide for Effectiveness and Comparative Effectiveness Reviews.[5] To assess methodological quality, we employed the strategy to (1) apply predefined criteria for quality and critical appraisal and (2) arrive at a summary judgment of the study's quality. To indicate the summary judgment of the quality of the individual studies, we used the summary ratings of good, fair, or poor.

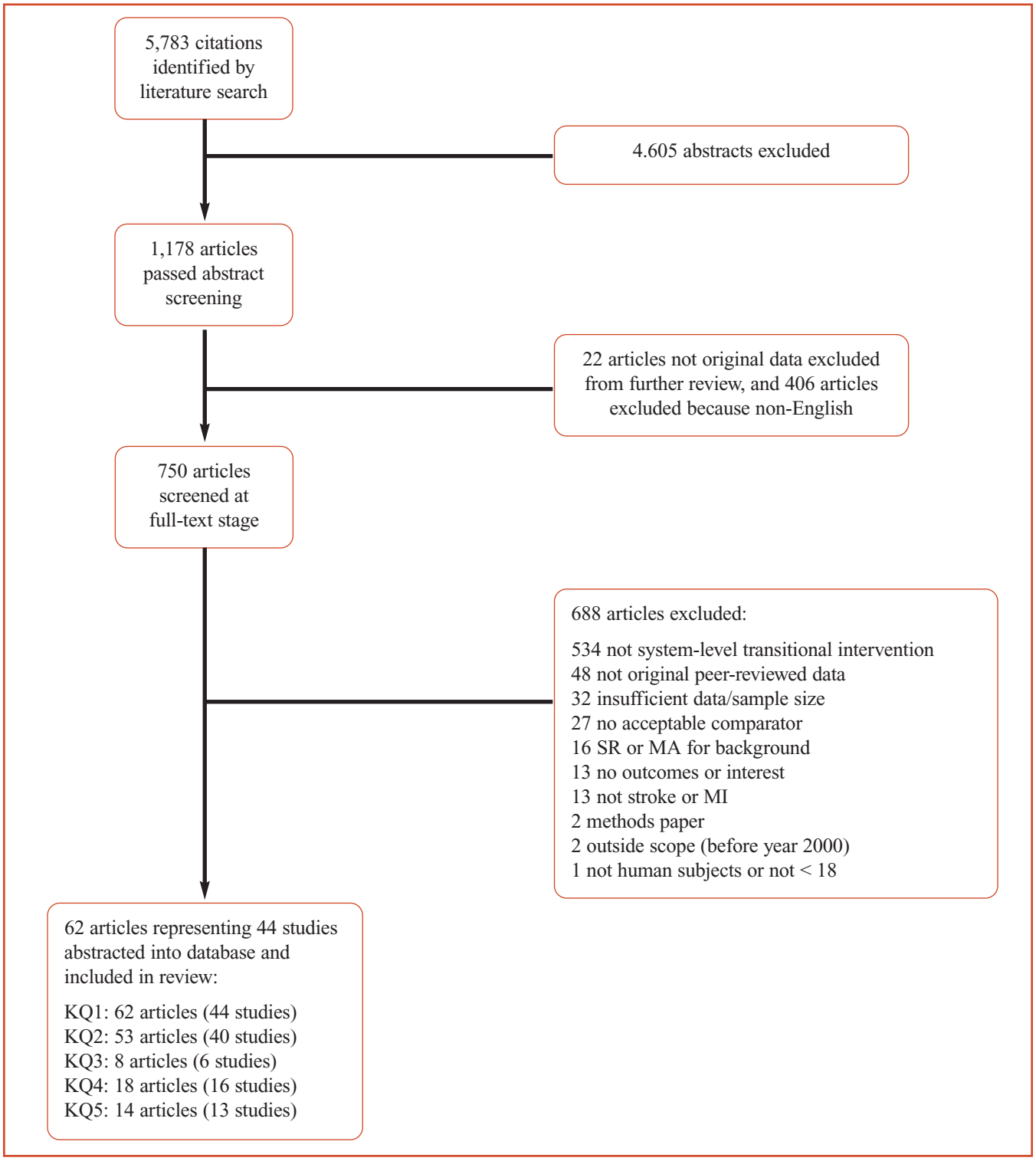
To assess applicability, we used data abstracted on the population studied, the intervention and comparator, the outcomes measured, settings, and timing of assessments to identify specific issues that may limit the applicability of individual studies or a body of evidence as recommended in the Methods Guide.[5] We used these data to evaluate the applicability to clinical practice, paying special attention to study eligibility criteria, baseline demographic features of the enrolled population (such as age, disease severity, and comorbid conditions) in comparison to the target population, characteristics of the transition of care intervention used in comparison with therapies currently in use in routine clinical practice, and clinical relevance and timing of the outcome measures.

4. **Data Synthesis and Analysis**. The studies included in this review varied in the types of transition of care services, the delivery of the intervention tested, the comparator group, and the outcomes measured. Therefore, we were unable to group studies with similar transitions of care, interventions, and outcomes for a formal meta-analysis. Instead, we grouped studies with similar transition of care components and described the interventions, comparators, and outcomes.

Results

The flow of articles through the literature search and screening process is depicted in Figure B. Of the 5,783 citations identified by our searches, 4,605 were excluded at the abstract screening stage. Of the 1,178 articles that passed the initial abstract screening, 22 were not original data (e.g., editorials), which were reviewed separately and excluded from further review, and 406 articles were excluded because they were non-English publications. The remaining 750 articles went on to full-text screening. Of these, 688 were excluded, leaving a total of 62 included articles (representing 44 studies).

Figure B. Literature flow diagram



Abbreviations: KQ = Key Question; MA = meta-analysis; MI = myocardial infarction; SR = systematic review

KQ 1. After a comprehensive review of the 62 articles (44 studies), we were able to group transition of care interventions into four types depending on which phase of an episode of illness the patient was in. *Intervention type 1* included several components of care that were begun while patients were in hospital but being prepared for discharge. *Intervention type 2* included all components of education, whether started during the hospitalization (type 2a) or after discharge (type 2b). *Intervention type 3* included community-based support systems involving both lay and professional support and visitation (by physicians, nurses, therapists, etc.). *Intervention type 4* included the transition of patients to chronic disease management models of care.

KQ 2. Out of 53 articles (40 studies) reporting outcome measures relevant to KQ 2, we found moderate evidence to support the benefit of two components of hospital-initiated planning (intervention type 1): early supported discharge for stroke patients and referral for specialty followup after MI. Early supported discharge was associated with a reduction in hospital length of stay without adversely impacting survival, quality of life, or functional disability. In some cases, early supported discharge for stroke patients may also have reduced caregiver strain and improved some aspects of quality of life among patients as well as caregivers. Specialty followup after MI, as a component of hospital discharge planning (intervention type 1) was also associated with a reduction in mortality. There was insufficient evidence to support any specific hospital- or community-based educational or support programs in terms of their impact on the KQ 2 measures.

KQ 3. There was insufficient evidence to determine if there were differential rates of adverse events for transition of care interventions or components of transition of care services because rates for adverse events were similar for intervention and usual-care groups in the eight articles (six studies) that reported risks, adverse events, or harms. The six studies included only patients with stroke, and thus no conclusions could be made in terms of KQ 3 for patients with MI.

KQ 4. In KQ 4 we examined whether transition of care services improved coordination of care among multiple subspecialty care providers and whether new providers were added to the care plan as part of an improvement in care for patients with stroke or MI. Of the 18 articles (16 studies) that reported system-level outcomes, there was insufficient evidence to support any of the four intervention types although there was a suggestion that some interventions may have a limited benefit.

KQ 5. We did not find evidence that benefits or harms of transition of care services varied on the basis of patient characteristics (disease etiology, disease severity or comorbidities) or system characteristics (geography, insurance status, sociodemographic). Of 14 articles (13 studies) reviewed, the most commonly reported characteristics were disease severity, age, sex, and presence or absence of depressive symptoms. Only disease severity showed a trend, suggesting that patients with less severe strokes (lower on National Institutes of Health Stroke Scale) demonstrated a benefit from transition of care interventions compared with those with more severe deficits.

Table B provides an aggregated view of the strength of evidence and brief conclusions from this review.

Table B. Summary of findings

Key Question	Strength of Evidence	Summary
Key Question 1: For patients hospitalized with first or recurrent stroke or myocardial infarction (MI), what are the key components of transition of care services? Can these components be grouped in a taxonomy, and are they based on a particular theory?	Not relevant to this key question	44 studies (62 articles—10 good quality, 41 fair, 11 poor) described the key components of transition of care services. Conclusion: Transition of care interventions were grouped into 4 intervention types that each began in a different phase of an episode of illness: • Intervention type 1: hospital-initiated support for discharge to home (13 studies) • Intervention type 2: patient and family education interventions, both hospital-based and community-based (7 studies) • Intervention type 3: community-based models of support (20 studies) • Intervention type 4: chronic disease management models of care (4 studies)
Key Question 2: Do transition of care services improve functional status and quality of life and reduce hospital readmission, morbidity, and mortality (up to 1 year postevent)?	Moderate to insufficient	40 studies (53 articles—8 good quality, 36 fair, 9 poor) reported functional status, quality of life, readmission, morbidity, and mortality outcomes. Eight studies used a hospital-initiated support intervention (intervention type 1). Early supported discharge was a component of 6 of these studies; improvement was reported in 8 articles representing 4 studies. 2 of these showed a reduction in mortality when MI patients were cared for using guideline-based practice and specialty followup (intervention type 1). Conclusions: • Early supported discharge as a component of hospital-initiated support (intervention type 1) after stroke was associated with a reduction in total hospital length of stay without adverse effects on death or functional recovery (moderate strength of evidence). • Specialty followup, a component of hospital-initiated support (intervention type 1), after MI and guideline-based practice were associated with a reduction in mortality (low strength of evidence). • There was insufficient evidence to support a beneficial role for intervention types 3 or 4 in terms of improvement in functional status; quality of life; and reduction in hospital readmission, morbidity, and mortality. • There was little consistency in the transition of care interventions from one study to another. • There was much variability in the selection of outcome measures for evaluating the success of transition of care interventions.

Table B. Summary of findings (continued)		
Key Question	**Strength of Evidence**	**Summary**
Key Question 3: What are the associated risks, adverse events, or potential harms—both system based and patient-based—of transition of care services?	Insufficient	6 studies (8 articles—2 good quality, 5 fair, 1 poor) reported risks, adverse events, or harms. Of the ones that did, all involved patients with stroke and none involved patients with MI. Conclusion: There was insufficient evidence to determine if there were differential rates of adverse events for transition of care interventions or components of transition of care services because rates for adverse events were similar for intervention and usual-care groups.
Key Question 4: Do transition of care services improve aspects of systems of care for patients with stroke or MI? Is there improved coordination among multiple subspecialty care providers, and are there new providers added to the care plan as a result of transition of care services?	Moderate to Insufficient	16 studies (18 articles—2 good quality, 13 fair, 3 poor) reported system-level outcomes. Given the available data, we found that: • The use of emergency department services may be lessened by early education regarding stroke or MI symptoms (intervention type 2). • Disease-management programs may be more effective than remote phone calls for patients with MI (intervention type 3). • Early return to work after MI may be safe and may be cost effective from a societal perspective (intervention type 1). It did not seem to increase health care utilization, and it may save the cost of cardiac rehabilitation in low-risk patients. • Early supported discharge in low-risk stroke patients reduced hospital days and was thus cost effective (intervention type 1). It did not increase burden on family providers (moderate level of evidence). • Physician appointments or home visits by physical therapists may reduce readmission rates for stroke patients (intervention type 3). Visits by nurses did not produce the same effects (intervention type 3). • Family support and case management services may reduce visits to physical therapists and specialists (intervention type 3). Conclusion: From a system resource perspective, the evidence for transition of care services for patients with stroke or MI was insufficient to provide a full recommendation because of study designs, sample sizes, and non-U.S. populations.

Table B. Summary of findings (continued)		
Key Question	**Strength of Evidence**	**Summary**
Key Question 5: Do benefits and harms of transition of care services vary by characteristics—both patient-based and system-based—such as disease etiology and severity, comorbidities, sociodemographic factors, training of the health care providers, participants (patients, caregivers), geography (rural/urban, regional variations), and insurance status?	Insufficient	13 studies (14 articles—2 good quality, 10 fair, 2 poor) described benefits and harms of transition of care services as they vary by patient- or system-based characteristics. The most commonly reported characteristics in transition of care studies were disease severity, age, sex, and presence or absence of depressive symptoms. Conclusions: • There was a lack of consistency by which characteristics were measured or reported. • There was insufficient evidence to be able make conclusions regarding the impact of transition of care services on the basis of the patient's insurance status. • There was no consistent evidence that demographic groups benefited or were harmed by transition of care services. • There was a trend suggesting that patients with less severe strokes (lower on NIH Stroke Scale) demonstrated a benefit from transition of care interventions compared with those with more severe deficits.

Abbreviations: MI = myocardial infarction; NIH = National Institutes of Health

Discussion

We conducted a systematic review of the indexed medical literature to evaluate the evidence for transition of care services and programs that improve the posthospitalization quality of care for patients who have undergone strokes or MIs. A challenge in preparing this review was in defining the concept of "transition of care" following hospitalization with stroke or MI. We focused on the process that a patient underwent as they left the acute-care hospital and reintegrated into society. We found Coleman's definition of transition of care most appropriate for our purposes: "the set of actions designed to ensure the coordination and continuity of health care as patients transfer between different locations or different levels of care within the same location."[1] We were guided by Donabedian's framework of structure, process, and outcome in the development of a taxonomy of transition of care interventions for MI and stroke. [6-8]

In this review, we found that the process of transitioning the care of a patient from the hospital to the community began in the hospital as part of the discharge planning process (intervention type 1). This phase included interventions such as predetermined integrated-care pathways, early supported discharge, extended stroke unit services, and rehabilitation coordination with community services. Referral for subsequent subspecialty care followup was also included as part of intervention type 1 if it was part of the discharge planning. Education of the patient and family prior discharge was also initiated during the acute hospitalization (intervention type 2). Educational programs varied from those that provided information packages to direct teaching by subspecialty trained nurses.

Following hospital discharge, community-based support of the patient and family (intervention type 3) could be provided through advanced practice nurse care managers, primary care and specialty-based medical practitioners, and multidisciplinary care teams (including doctors; nurses; social workers; and physical, occupational, and speech therapists). This support could be provided in person at the patient's home, by telephone, or at a clinical practice setting (physician's office, outpatient rehabilitation setting or common meeting place for support groups). Ongoing patient and family education could also be maintained at the community level, such as the provision of medical-focused manuals, rehabilitation and lifestyle information, videotapes, and telephone-based educational programs.

Chronic disease management (intervention type 4) was reviewed as part of the process of transition of care, and a few disease management models were identified that included the outcomes of interest in our review: one MI and three stroke intervention programs.

Despite a conceptual basis to support the transition of care, we found only limited evidence in favor of some components of hospital-initiated support (intervention type 1): transition of care after stroke and specialty followup after MI. Transition of care interventions seemed able to reduce the total number of hospitalized days without adversely impacting long-term functional recovery or death. Specialty care followup after MI was associated with reduced mortality. There were no transition of care interventions that consistently improved functional recovery after stroke or MI, and none seemed to consistently improve quality of life or psychosocial factors such as strain of care, anxiety, or depression.

Limitations of the Review Process

Across the 62 articles (44 studies) that met the inclusion criteria for this review, the major limitations were inadequate sample size, heterogeneity of outcome measures, lack of definition for the usual care group, and numerous studies conducted outside of U.S. settings. Few studies were designed with a single primary endpoint but rather simultaneously reported multiple outcome measures, frequently with an inadequate sample size to justify multiple statistical comparisons. The reported outcome measures included both validated and unvalidated outcome scales as well as combinations of the two. The treatment interventions were not always clearly described. Some studies included more than one intervention, which made it difficult to determine the effect of individual components on clinical outcomes. The most limiting aspect of the studies reviewed was that they did not define what constituted the control intervention, which in many cases was simply referred to as "usual care." The latter made cross-study comparisons challenging. This heterogeneity in the intervention and control treatments precluded conducting a meta-analysis of the cohort of studies. A significant number of these studies (some of the better ones) were conducted outside the United States in countries with significantly different health care systems than ours (frequently in countries with single-payer systems), thus making translation of their results more challenging.

Conclusions

Although we were able to define a conceptual framework and a specific taxonomy for transition of care services that served as the foundation for evaluating the published literature, the evidence for efficacy in the setting of stroke and MI was insufficient. A number of the studies we reviewed were based on a solid conceptual framework with reasonable study designs but had too few patients to be able to reach statistically valid conclusions. Other studies did not follow their subjects long enough, and too many studies used inconsistent endpoints to be able to make comparisons. Although acute MI and stroke share many risk factors, the scope of medical needs that each of these two populations of patients experience is quite different. Even though we attempted to evaluate the individual components of transition of care services for each disease entity, we found that each medical condition presented unique care issues that required specific transition of care interventions. This was most true for the utilization of rehabilitation services following stroke.

As the population of the United States gets older and the number of patients experiencing MI or stroke increases, it will be imperative to have transition of care interventions that have proven to be effective in improving functional outcomes and facilitating transfer of care from a hospital-based system to a community-based medical system while at the same time effectively utilizing health care resources to maintain health. Based on the findings of this review, few studies support the adoption of any specific transition of care program as a matter of health care policy. Some components, such as early supported discharge following stroke, appear to shorten length of stay and improve short-term disease. A similar approach following MI with early return to work also seems to be safe and cost effective. Additional well-structured research performed in the United States is necessary before concluding that a specific approach is effective and worthy of widespread adoption. These studies will need to be disease focused because stroke and MI involve quite different populations with unique challenges to overcome.

Implications for Future Research

Although we defined a taxonomy for the purposes of our review, we believe that a consensus needs to be reached among investigators on a unified taxonomy and conceptual framework that defines the constituent components in the transition of care process following stroke and MI. We found that this process could be evaluated in the context of four different types of interventions, each with a multitude of components that could be evaluated individually for clinical and statistical effectiveness (i.e., the effects of an education program on medication compliance) or together as components of an integrated system (the effectiveness of "early supported discharge" on functional recovery after stroke when compared to "standard rehabilitation"). Regardless of the method chosen, the intervention being tested needs to be clearly defined at the outset of the study as well as the expected outcome measures that will be used to evaluate the effectiveness of the intervention.

The control treatment used for comparison against the intervention also needs to be clearly defined in terms of the standard prehospitalization and posthospitalization care offered because the standard of care in one health care system may be quite different in another. This is most relevant in the setting of multicenter trials. Having a manual of operations with clear definitions of interventions and control therapies would allow for standardization of treatments across centers. Given the heterogeneity of the interventions as well as the systems under which these studies are carried out, measures of intervention fidelity (adherence to the protocol) need to be built into each study in order to evaluate whether the interventions are feasible and effective.

In addition to consistency in the terms used to describe the components of transition, there also needs to be a set of validated and clinically relevant outcomes. The outcomes chosen for a study should, by definition, be ones that are responsive to the intervention being tested. After an appropriate primary outcome is selected for study, the expected treatment effect needs to be presented along with statistical justification for the sample size chosen for the study—thus reducing the likelihood of having an underpowered trial. Secondary outcomes could serve as the basis for hypothesis testing in future trials. A number of the studies we reviewed showed a promising trend toward benefit; however, they were underpowered, and outcomes were diluted by incorporating too many variables. There are interventions that would allow an investigator to focus on one component of the system at a time and potentially create, in a stepwise fashion, a set of clinically proven interventions in a transition of care pathway.

We found that despite multiple strategies aimed at educating the patient and family about the patient's medical condition, the long-term benefit of this effort seemed less clear. How to optimize health care education in order to modify

behavior needs further study if it is going to be incorporated as a significant component of the transition process. It is already a cornerstone for the Joint Commission Primary Stroke Center designation for a hospital, yet there are few data on the optimal method for stroke education or whether it is associated with any benefit to the patient or family.

We found little evidence regarding the optimal method of maintaining continuity of care following hospital discharge. Despite the rapid development of electronic medical records, there was limited evidence about the effectiveness of this tool as a component of transition of care. The costs associated with widespread implementation are not insignificant, and yet an optimal method for implementation in a system of health care such as that in the United States has not been evaluated.

Two examples of components suited for focused study are the role of health-related educational efforts in evaluating medication compliance and the implementation of an electronic medical record to facilitate communication among multiple providers (primary care, specialty care, care coordinators, rehabilitation specialists) after an acute hospitalization.

In other circumstances, it may not be possible to study subcomponents of an intervention; instead, a systems approach to care would need to be evaluated. Multidisciplinary discharge-planning teams (composed of doctors, nurses, social workers, and physical, occupational, and speech therapists) are an example of the latter. In that case, the entire team program could be tested against "standard" single-provider discharge planning.

For the results of an intervention to be generalizable to health care systems across the United States, the study should involve multiple centers across states as well as across health care systems (private practice groups, academic medical centers, health maintenance organizations, etc.). Many of the studies we reviewed were conducted in Europe, Australia, and Canada with single-payer systems that could affect the ability to extrapolate their study conclusions to the United States. More studies should be conducted under the health care system for which the intervention is intended to benefit.

Finally, future studies on transition of care could assess whether there should be separate care coordination trajectories for stroke and MI, or whether there is sufficient overlap in these interventions such that these care paradigms can translate to the general hospitalized population as a whole. For example, the disease state most studied in transition of care research (and demonstration projects) is congestive heart failure.[9] Programs developed for congestive heart failure in the future could be applied to acute MI or stroke and systematically evaluated. Future research that addresses whether transition of care interventions should be disease specific or be recommended for a general high-risk population would answer this important question. The challenges around transition of care are being recognized in all health care reform initiatives, and the Affordable Care Act of 2010, Section 3026, provides funding to test transition of care models for high-risk Medicare beneficiaries.

Glossary

AHRQ	Agency for Healthcare Research and Quality
CDC	Centers for Disease Control and Prevention
CINAHL	Cumulative Index to Nursing and Allied Health Literature
EPC	Evidence-based Practice Center
MeSH	Medical Subject Heading
MI	myocardial infarction
TEP	Technical Expert Panel

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Full Report

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