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Transition of Care for Acute Stroke and Myocardial Infarction Patients From Hospitalization to Rehabilitation, Recovery, and Secondary Prevention

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Structured Abstract

Objectives: To review the available published literature to assess whether evidence supports a beneficial role for coordinated transition of care services for the postacute care of patients hospitalized with first or recurrent stroke or myocardial infarction (MI). This review was framed around five areas of investigation: (1) key components of transition of care services, (2) evidence for improvement in functional outcomes, morbidity, mortality, and quality of life, (3) associated risks or potential harms, (4) evidence for improvement in systems of care, and (5) evidence that benefits and harms vary by patient-based or system-based characteristics.

Data Sources: MEDLINE®, CINAHL®, Cochrane Database of Systematic Reviews, and Embase®.

Review Methods: We included studies published in English from 2000 to 2010 that specified postacute hospitalization transition of care services as well as prevention of recurrent stroke or MI.

Results: A total of 62 articles representing 44 studies were included for data abstraction. Transition of care interventions were grouped into four categories: (1) hospital-based preparation for discharge was the initial stage in the transition of care process, (2) patient and family education interventions were started during hospitalization but were continued at the community level, (3) community-based models of support followed hospital discharge, and (4) chronic disease management models of care assumed the responsibility for long-term care. Early supported discharge after stroke was associated with reduced total hospital length of stay without adverse effects on functional recovery, and specialty care after MI was associated with reduced mortality. Because of several methodological shortcomings, most studies did not consistently demonstrate that any specific intervention resulted in improved patient- or system-based outcomes. There was inconsistency in the definition of what constituted a component of transition of care compared to "standard care." Standard care was poorly defined, and nearly all studies were underpowered to demonstrate a statistical benefit. The endpoints varied greatly from study to study. Nearly all the studies were single-site based, and most (26 of 44) were conducted in countries with national health care systems quite different from that of the U.S., therefore limiting their generalizability.

Conclusions: Although a basis for the definition of transition of care exists, more consensus is needed on the definition of the interventions and the outcomes appropriate to those interventions. There was limited evidence that two components of hospital-based preparation for discharge (early supported discharge after stroke and specialty care followup after MI) were associated with beneficial effects. No other interventions had sufficient evidence of benefit based on the findings of this systematic review. The adoption of a standard set of definitions, a refinement in the methodology used to study transition of care, and appropriate selection of patient-centered and policy-relevant outcomes should be employed to draw valid conclusions pertaining to specific components of transition of care.

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Effective Health Care

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 and Medicaid Services (http://www.cms.gov/), the National Quality Forum (http://www.qualityforum.org/), and the Institute of Medicine (http://www.iom.edu/) have identified improved transitions in care as priorities for demonstration projects and research to reduce rehospitalizations and improve 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," and it requires interdisciplinary programs. 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 the Agency for Healthcare Research and Quality's (AHRQ's) Evidence-based Practice Center (EPC) Program to 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 MIs. The results of this review will inform the CDC about the current strength of evidence as they develop needs for 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. 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. 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, rehabilitations 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 the 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 the postacute management have a beneficial effect on patient outcomes, processes of care, or health care utilization.

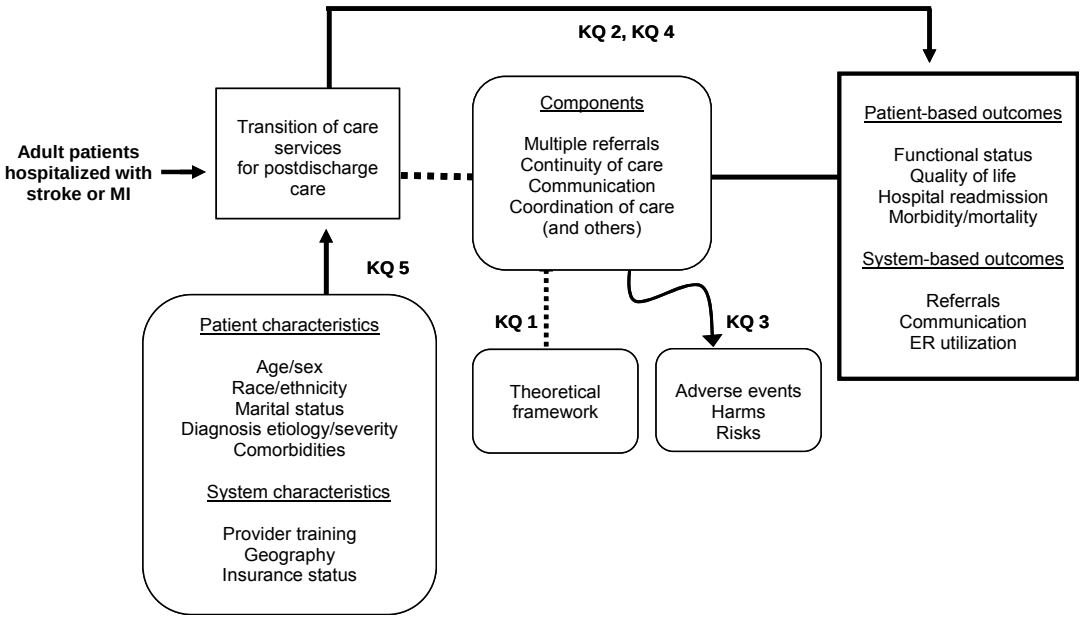
The key questions considered in this systematic review are:

- **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?
- **Key Question 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)?
- **Key Question 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?
- **Key Question 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?
- **Key Question 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 ES-1) 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 ES-1. Analytic Framework



Abbreviations: ER = emergency room, KQ = key question, MI = myocardial infarction

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 project development phase of the project. The report is also posted for public comment. A summary and disposition of the comments from peer and public reviewers will be prepared and submitted to AHRQ.

2. Data Sources and Selection. The comprehensive literature search included electronic searching of peer-reviewed literature databases. 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) key word 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 ES-1 shows the inclusion and exclusion criteria for the key questions.

Table ES-1. Inclusion and Exclusion Criteria

Category	Criteria

Study population	KQs 1—5:
	• Adults ≥ 18 years of age who were discharged, or were preparing to be discharged, from a hospitalization for the following two conditions:
	  o **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.
	  o **Stroke** (acute ischemic stroke or intracerebral hemorrhage) was defined as a focal neurologic deficit lasting more than 24 hours that is 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*.
	• 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 • 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, 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 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

Category	Criteria
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)
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: o System-level of analysis: Academic versus community hospital, specialist versus general health care provider, urban versus rural setting o 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: 3 months or longer 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

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 over 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 is 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*. 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.

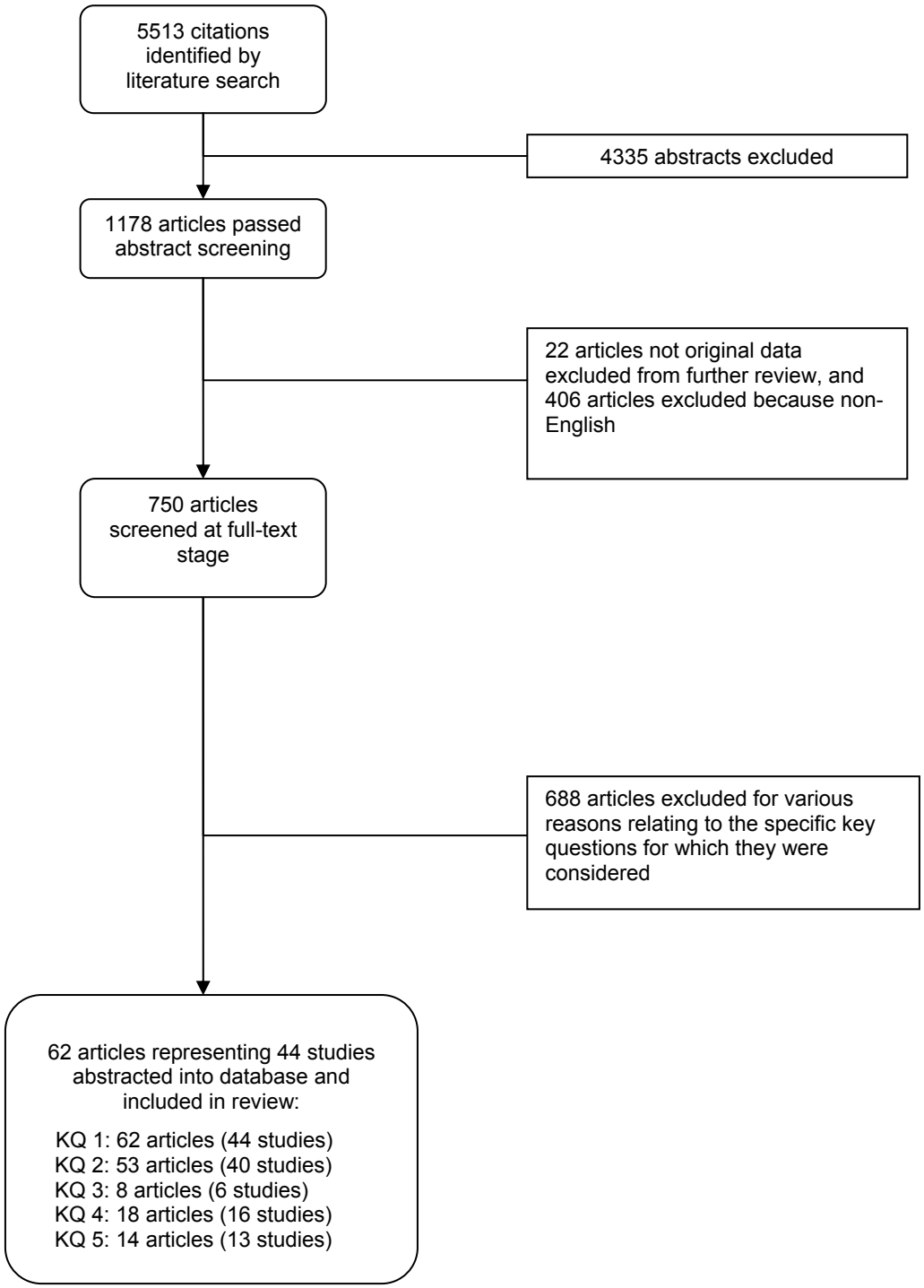
To assess applicability, we used data abstracted on the population studied, the intervention and comparator, the outcomes measured, settings, and timing of assessments to identify specific issues that may limit the applicability of individual studies or a body of evidence as recommended in the *Methods Guide*. 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 ES-2. Of the 5513 citations identified by our searches, 4335 were excluded at the abstract screening stage. Of the 1178 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 ES-2. Literature Flow Diagram



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-based planning (intervention type 1): early supported discharge 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 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 NIH Stroke Scale) demonstrated a benefit from transition of care interventions compared to those with more severe deficits.

Table ES-2 provides an aggregated view of the strength of evidence and brief conclusions from this review.

Table ES-2. 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-based preparation 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. 8 studies used a hospital-based preparation 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-based discharge planning (type 1 intervention) 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-based preparation (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.

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.

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 NIH Stroke Scale) demonstrated a benefit from transition of care interventions compared to those with more severe deficits.

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." 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.

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 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 their 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 their family (intervention type 3) could be provided through advanced practice nurse care managers, primary care and specialty-based medical practitioners, and multidisciplinary care teams. 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-based discharge planning (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. 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 U.S. in countries with significantly different health care systems than ours (frequently in countries with single-payer systems), thus making translation of their results inappropriate.

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 that 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 U.S. 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, 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 U.S. 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 since 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 were 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 that 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 different strategies aimed at educating the patient and their families regarding their 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 U.S. has not been evaluated.

Two examples of components that are 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 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 U.S., 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 U.S. More studies should be conducted under the health care system for which the intervention is intended to benefit.

Glossary

AHRQ	Agency for Healthcare Research and Quality
AIS	acute ischemic stroke
CDC	Centers for Disease Control and Prevention
CINAHL	Cumulative Index to Nursing and Allied Health Literature
DHDSP	Division for Heart Disease and Stroke Prevention
EPC	Evidence-based Practice Center
ICH	intracerebral hemorrhage
MeSH	Medical Subject Heading
MI	myocardial infarction
NSTEMI	non–ST elevation myocardial infarction
RCT	randomized controlled trial
SAH	subarachnoid hemorrhage
STEMI	ST elevation myocardial infarction
TEP	Technical Expert Panel
TIA	transient ischemic attack

References

Please refer to the reference list in the full report for documentation of statements contained in the Executive Summary.

Internet Citation

[To be added in the final report.]

Introduction

Background

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 it requires interdisciplinary programs. 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 the Agency for Healthcare Research and Quality's (AHRQ's) Evidence-based Practice Center (EPC) Program to 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 MIs. The results of this review will inform the CDC about the current strength of evidence as they develop needs for 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. State health departments are developing strategic and comprehensive plans for quality improvement programs for health systems, communities, and individuals to advance the transition of care. Their decisions should be informed by the current strength of evidence for transition of care models implemented during acute care, hospitalizations, and postacute settings of care (e.g., skilled nursing facilities, inpatient rehabilitation centers, community). Yet, the best practices for care transitions are not well established.

The mission of the Division for Heart Disease and Stroke Prevention (DHDSP) at the CDC is to provide public health leadership to improve cardiovascular health, reduce the burden, and eliminate disparities associated with heart disease and stroke. Cardiovascular disease and stroke account for 15 percent of the total health expenditures in 2007,[2] and the total estimated costs for both are over $286 billion per year.[3] Advances in the management and quality of acute care have contributed to reduced mortality in both conditions.[4] Yet some of the social and economic consequences of MI and stroke are their contribution to the burden of poor health, chronic disease, and disability rather than death. MIs and strokes contribute to, or become, chronic diseases due to the high risks of rehospitalization, functional decline, disability, and future cardiovascular events and second strokes.

The median risk-standardized 30-day readmission rate for acute MI is approximately 20 percent.[5] 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.[6] 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, rehabilitations centers, skilled nursing facilities), community-based services, and patients and their families.

Most of the programs supporting transition of care have been developed for congestive heart failure[7,8] and older adults with multiple comorbidities.[1,9] Acute MI and stroke also are complex health conditions that require effective interventions to better manage transition of care. However, there are major gaps in knowledge about best practices for transition of care for MI and stroke. In 2007, an AHRQ technical review identified multiple quality gaps in the coordination of chronic disease care,[10] and there was only one study of stroke and none of MI included in that review.

There are some inconsistencies in the early literature on transition of care models, depending on the focus of the study and the disciplines leading the interventions (nursing, medicine, rehabilitation).[11] 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. With the advent of transition of care models and methods to integrate service delivery, it is imperative that we synthesize the evidence to find promising models of transition of care or to identify gaps in the evidence and needed research and program development to improve the quality of management of two of the most common health problems. These efforts are consistent with the Institute of Medicine's priorities to (1) compare the effectiveness of diverse models of transition support services for adults with complex health care needs (e.g., the elderly, homeless, mentally challenged) after hospital discharge and (2) compare the effectiveness of different quality improvement strategies in disease prevention, acute care, chronic disease care, and rehabilitation services for diverse populations of children and adults.[12]

Scope and Key Questions

The first challenge of this systematic review was to consider the pathways for the transition of care. Transitions may include those that are direct to the outpatient environment as well as those to and from intermediate care environments. In addition, the components of transition of care may occur separately or in aggregate, which makes it important to know how the components are categorized and described within a clear taxonomy.

The second challenge was to dissect those data relevant to the disease states of interest. The incidence of stroke and MI increases with age, as does the presence of other chronic conditions that may be driving downstream outcomes. Also, stroke and MI are not exclusively diseases of the elderly, so it is fundamental to explore stroke and MI transitions within the population as a whole as well as in the older or chronically ill population.

While both stroke and MI result from disorders of the vascular system—and as such share many common risk factors—each medical condition presents unique challenges regarding transitions across care settings. Stroke patients more often transition from hospital to inpatient rehabilitation facilities, nursing homes for rehabilitation or palliative care, or home health services. Also, patients with stroke have more long-term physical disability and cognitive impairments that may require rehabilitative services or long-term institutional support. In contrast, patients with MI are more likely to be discharged directly home and receive outpatient

transition of care services. Additionally, patients with stroke are more likely to be older, female, and African American than are patients with MI.[13]

As part of this systematic review, we explored features of transition of care that are common to both vascular disorders as well as features that are unique to disease-specific needs. The key questions considered in this review were:

- **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?
- **Key Question 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)?
- **Key Question 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?
- **Key Question 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?
- **Key Question 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?

Purpose of This Report

The goal of this evidence report was to review the literature that explored the opportunities and limitations of existing transition of care models, such as patient resource management, that are available for patients as they navigate from acute hospital care to rehabilitation services and eventually to independent or dependent living. Each step in the transition process was evaluated on its own merits as well as how it integrated the care of patients as they were discharged from the hospital and sought care with other providers, through different health care systems or in community programs. We reviewed the available published literature to assess whether evidence existed to support a beneficial role for coordinated transition of care for the postacute management period of medical, rehabilitative, and nursing services. Metrics of successful application of transition of care services included hospital readmission rates, second events (stroke or MI), resource utilization (cardiac or stroke rehabilitation, medical followup), functional status, medication adherence, and compliance with health care programs aimed at secondary prevention.

Role of the Technical Expert Panel

We identified experts in the field of transition of care 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.

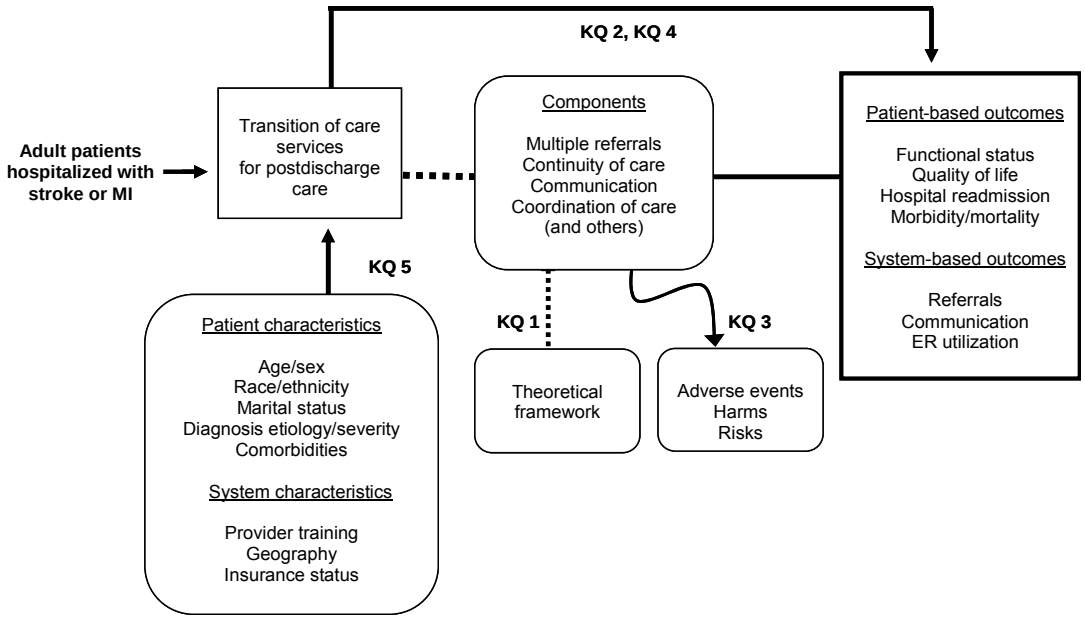
Members of our TEP represented a broad range of experience relevant to our topic because of their extensive knowledge of the literature. They included experts in cardiology, vascular neurology, community-based medicine and rehabilitation, and geriatric medicine. Additionally, the TEP included representatives from the National Institutes of Health as well as Blue Cross and Blue Shield.

Methods

Analytic Framework

The analytic framework (Figure 1) 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 1. Analytic Framework



Abbreviations: ER = emergency room, KQ = key question, MI = myocardial infarction

Literature Search Strategy

Sources Searched

The comprehensive literature search involved electronic searching of peer-reviewed literature databases. These databases included the Cumulative Index to Nursing and Allied Health Literature (CINAHL®), MEDLINE® accessed via PubMed®, the 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.

Screening for Inclusion and Exclusion

We developed a list of article inclusion and exclusion criteria for the key questions (Table 1) and modified the list after discussion with the TEP.

Table 1. Inclusion and Exclusion Criteria

Category	Criteria

Study population	KQs 1—5:
	• Adults ≥ 18 years of age who were discharged, or were preparing to be discharged, from a hospitalization for the following two conditions:
	  o **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.
	  o **Stroke** (acute ischemic stroke or intracerebral hemorrhage) was defined as a focal neurologic deficit lasting more than 24 hours that is 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*.
	• 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 • 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

Category	Criteria
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, 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 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)

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:
	  o System-level of analysis: Academic versus community hospital, specialist versus general health care provider, urban versus rural setting
	  o 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: 3 months or longer 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

Process for Study Selection

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) key word 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.

We incorporated transition of care studies that specified postacute hospitalization transition of care services as well as prevention of recurrent MI or stroke. Naylor[7] identified keywords used in our search strategy (transitional care, discharge planning, care coordination, case management, continuity of care, referrals, postdischarge followup, patient assessment, patient needs, interventions, and evaluations), and we incorporated and built on this foundation. The exact search strings used in our strategy are given in Appendix A.

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.

Data Extraction and Data Management

Data from included reports were abstracted into the database by one reviewer and read over by a second reviewer. Data elements abstracted included study design, setting, geographic location, patient characteristics, transition of care components, outcomes, length of followup, adverse events, and 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. Appendix B lists the elements used in the data abstraction form. Appendix C contains a bibliography of all included studies organized alphabetically by author.

Individual Study Quality Assessment

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 is 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* (hereafter referred to as the *Methods Guide)*.[14] 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. Appendix B describes our quality assessment process, and Appendix D lists our quality assessment for each included study.

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*.[14] Appendix B describes our applicability assessment process, and Appendix D lists our applicability assessment for each included study. 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.

Data Synthesis

The studies included in this review varied in the types of transition of care service, 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.

Grading the Body of Evidence for Each Key Question

The strength of evidence for each key question was assessed using the approach described in the *Methods Guide*.[14] The evidence was evaluated using the four required domains: risk of bias (low, medium, or high), consistency (consistent, inconsistent, or unknown/not applicable), directness (direct or indirect), and precision (precise or imprecise). Additionally, when appropriate, the studies were evaluated for coherence, dose-response association, residual confounding, strength of association (magnitude of effect), publication bias, and applicability.

The strength of evidence was assigned an overall grade of High, Moderate, Low, or Insufficient according to the following four-level scale:

- High—High confidence that the evidence reflects the true effect. Further research is very unlikely to change our confidence in the estimate of effect.
- Moderate—Moderate confidence that the evidence reflects the true effect. Further research may change our confidence in the estimate of effect and may change the estimate.
- Low—Low confidence that the evidence reflects the true effect. Further research is likely to change the confidence in the estimate of effect and is likely to change the estimate.
- Insufficient—Evidence either is unavailable or does not permit estimation of effect.

Peer Review and Public Commentary

Nominations for peer reviewers were solicited from several sources, including the TEP and interested Federal agencies. The list of nominees was forwarded to AHRQ for vetting and approval. A list of reviewers submitting comments on this draft will be included in the final report.

Results

Literature Search and Screening

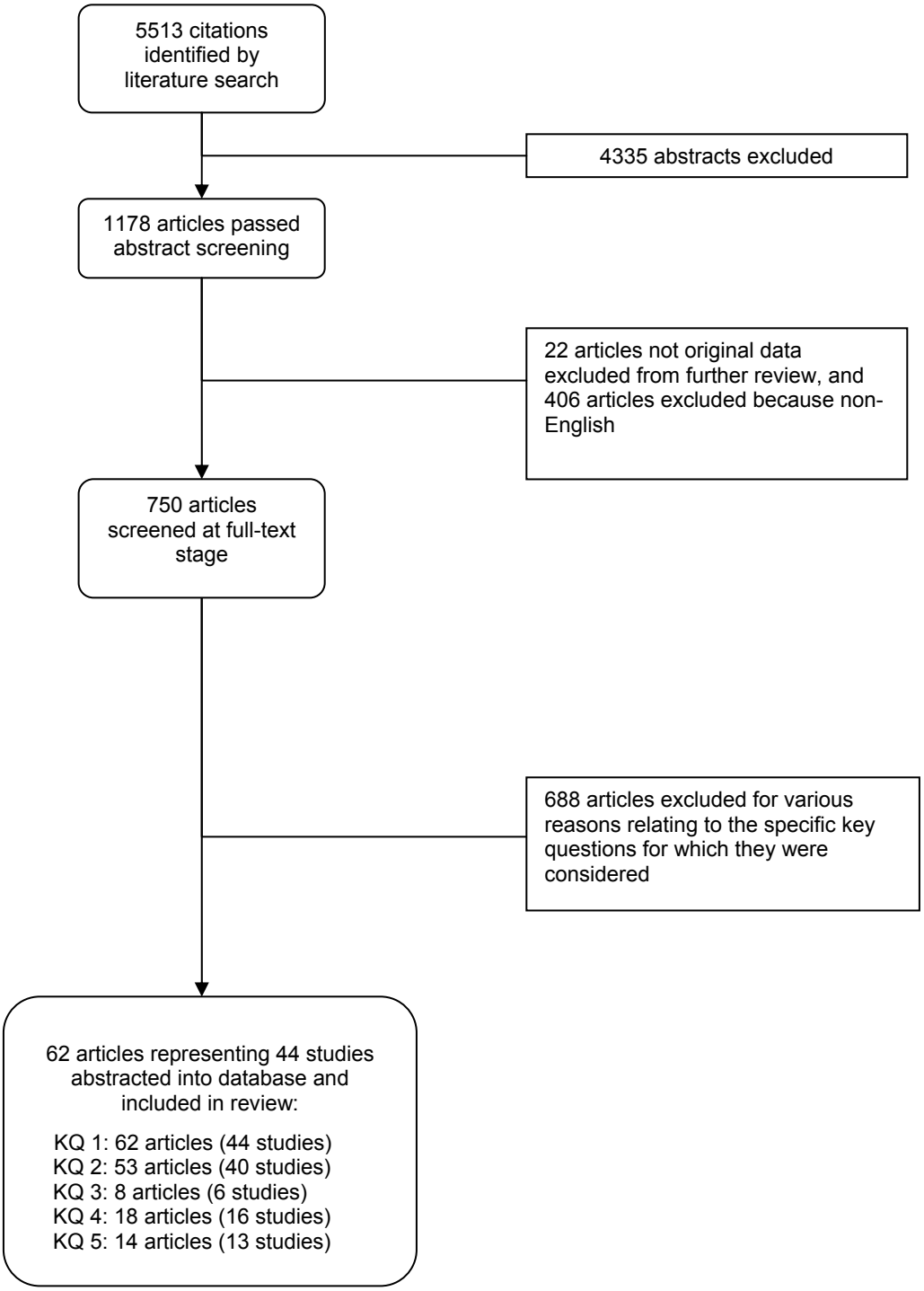
Searches of all sources identified a total of 5513 potentially relevant citations. Table 2 details the number of citations identified from each source.

Table 2. Sources of Citations

Source	Number unique of citations
MEDLINE	5260
CINAHL	17
Cochrane Database of Systematic Reviews	1
Embase	206
References of review articles and primary studies	16
Other (recommendations from staff at AHRQ or TEP or from project investigators)	13
Total	**5513**

Figure 2 describes the flow of literature through the screening process. Of the 5513 unique citations identified by our searches, 4335 were excluded at the abstract screening stage. Of the 1178 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). Appendix D provides a table of studies included in this review along with their quality rating, limitations to applicability, and relevant key questions. Appendix E provides a complete list of articles excluded at the full-text screening stage, with reasons for exclusion.

Figure 2. Literature Flow Diagram



Key Question 1

KQ 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?

Key Points

- Theory was rarely reported in clinical trial papers reporting study outcomes.
- Transition of care interventions for patients with MI or stroke were grouped into four categories of intervention, and each category began in a different phase of an episode of illness.
- The components of the different interventions were grouped into a taxonomy that addressed the type of transition relative to the phase of illness and care, type of intervention, recipient of the intervention, content of the intervention, facilitator of the intervention, method of recipient-to-facilitator contact, intensity and complexity, and outcomes.

Detailed Analysis

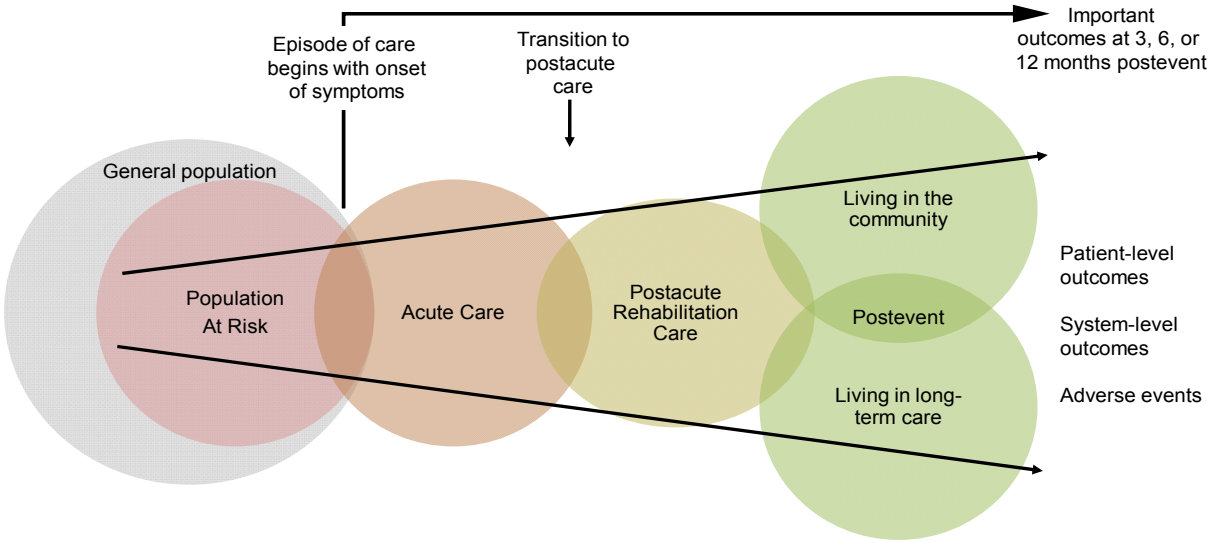
A patient experiencing an acute MI or stroke undergoes a number of transitions, from the onset of symptoms and hospital admission through the various settings of acute and subacute care before returning to the community or a final place of residence. This report focuses on the process of transitioning from an acute inpatient setting to an out-of-hospital setting. The transition may include (1) a return to home, (2) a transient stay in a setting that provides rehabilitation, or (3) relocation to a long-term care facility. As the individual moves through these various settings, a number of different health care providers may be involved in various configurations of care models to transition patients "home."

Before the effectiveness of the various approaches to transitioning patients home can be examined, the approaches need to be categorized and the components defined. We present the transition of care interventions and models categorized as they would be delivered in an episode of care and then describe the supporting theories and the structure and process of the different types that were identified. This presentation of the structural components and processes of transition of care services supports the KQs that are focused on outcomes.

Framework. We have adapted the National Quality Forum's episode of care framework for aligning the interventions and models identified in this literature review, modifying it only slightly to include stroke as well as MI (Figure 3). This framework, developed to guide measurement, essentially depicts the care pathway experienced by patients for an episode of illness such as an acute MI or stroke. Although the framework captures individuals prior to the acute event as they transition through the acute hospitalization and into followup care, our focus for this review is concentrated only on the transition out of the acute hospital stay. While we recognize that transitions of care as defined by Coleman et al.[1] occur even during the acute hospitalization, we focused on the transfer across settings. Thus, the acute-care hospital, and in some cases the acute hospital or the next setting for inpatient care, became our point of interest as the primary point of influence on recovery and maintenance of health for patients transitioning

home. We did not identify any studies that focused solely on the transition from an alternative inpatient setting such as a skilled nursing facility to home.

Figure 3. Framework for Episodes of Care



(Adapted from *Patient-Focused Episodes of Care* Framework, National Quality Forum 2010)

Literature identified. Four types of transition of care interventions were identified in this review of 62 articles (10 good quality, 41 fair, 11 poor) describing 44 studies:

(1) Hospital-based preparation for discharge to home or intermediary care units such as inpatient rehabilitation or skilled nursing facilities.
(2) 2a. Hospital-based patient and family education interventions
2b. Community-based patient and family education interventions
(3) Community-based models of support interventions
(4) Chronic disease management models of care

Each intervention type, as tested in the studies reviewed, was intended to transition the patient back to the community and promote recovery and positive outcomes. While all studies in this review measured 3-, 6-, or 12-month outcomes, the emphasis of the intervention weighted more heavily in either the acute hospital, as with types 1 and 2a, or the community, as with 2b, 3, and 4. The following tables describe the 44 interventions organized by type, first for stroke (Table 3, 27 stroke interventions published in 41 articles) and then for MI (Table 4, 17 MI interventions published in 21 articles).

Table 3. Transition of Care Interventions and Models for Stroke

Study	Type of intervention	Components	Theory
Askim et al., 2004[15] Askim et al., 2006[16]	Hospital-based preparation	Early supported discharge: Ordinary stroke unit service with rehabilitation and primary care services after discharge plus mobile stroke team from the stroke unit to focus on early and intensive task-specific exercise therapy in the patients' home; shared goal setting with team, physician, patient, and family if possible; and coordination with primary care.	None reported
Bautz-Holtert et al., 2002[17]	Hospital-based preparation	Early supported discharge: Project team did in-hospital assessment, discharge planning, and coordination of the continued rehabilitation provided by community services. Each patient had a multidisciplinary team, ongoing support and supervision, an outpatient clinic visit at 4 weeks, and the option for continued inpatient or outpatient rehabilitation.	None reported
Fjaertoft et al., 2003[18] Fjaertoft et al., 2004[19] Fjaertoft et al., 2005[20] Indredavik et al., 2000[21]	Hospital-based preparation	Extended stroke unit service, essentially the same as early supported discharge. Same as Askim et al.[15,16] (originally developed by Indredavik et al., 2000[21])	None reported
Grasel et al., 2005[22] Grasel et al., 2006[23]	Hospital-based preparation	Intensified Transition:(1) Psychoeducational seminar for caregivers, (2) individual training course at bedside for caregivers about care at home and how to reduce caregiver burden, (3) therapeutic weekend for patient at home before discharge with home evaluation, (4) 3-month telephone followup for counseling based on need.	None reported
Holmqvist et al., 2000[24] von Koch et al., 2000[25] von Koch et al., 2001[26]	Hospital-based preparation	Early supported discharge: Short-term admission to a hospital, followed by (where appropriate) early supported discharge with continuity of rehabilitation in the community (physical therapist, occupational therapist, speech and language pathologist, social worker consultation as needed).	None reported
Mayo et al., 2000[27] Teng et al., 2003[28]	Hospital-based preparation	Early supported discharge: prompt discharge from hospital with the immediate followup services for 4 weeks by a multidisciplinary team offering nursing, physical therapy, occupational therapy, speech therapy, and dietary consultation. Nursing or physical therapy took the lead for most patients.	None reported
Sulch et al., 2000[29] Sulch et al., 2002[30] Sulch et al., 2002[31]	Hospital-based preparation	Predetermined inpatient rehabilitation integrated-care pathway led by a stroke nurse.	None reported

Study	Type of intervention	Components	Theory
Torp et al., 2006[32]	Hospital-based preparation	Hospital-supported discharge: independent interdisciplinary stroke team consisting of an occupational therapist, a physiotherapist, and a physician from the rehabilitation unit who followed the patient until the last 7 days of the hospitalization. Team then took over the training and carried out home visits during the last 7 days of the hospital stay to establish personal contact. Postdischarge care included a comprehensive rehabilitation program for the patients for up to 30 days with a maximum of 10 home visits. They supervised patient, relatives, and home care professionals and handed over the care of the patient to local home care services through personal contact to the relevant health staff.	None reported
Clark et al., 2003[33]	Patient/family education (home-based)	Information package at discharge about stroke and its consequences, measures for reducing the risk of further stroke, practical coping suggestions, and information about community services and support structures. Home visits by social worker trained in family counseling techniques and provided based on family need.	Family systems theory
Hoffmann et al., 2007[34]	Patient/family education (hospital-based)	"What you need to know about stroke" system: stroke education based on and formatted for patients and delivered by research nurse.	None reported
Johnston et al., 2007[35]	Patient/family education (home-based)	Workbook with education about stroke and recovery, guidance on coping skills, and self-management instruction plus telephone followup; led by a nurse.	Cognitive behavioral theory
Mant et al., 2000[36] Mant et al., 2005[37]	Patient/family education (home-based)	Family support organizer provided information, emotional support, and was the liaison with other services. Facilitated through a combination of home and hospital visits and telephone calls tailored by need.	None reported
Sahebalzamani et al., 2009[38]	Patient/family education (home-based)	Education on activities of daily living in six to eight 2-hour sessions over 45 days (however, same booklet of information was given to control group); led by a nurse.	None reported

Study	Type of intervention	Components	Theory
Allen et al., 2002[39] Allen et al., 2009[40]	Community-based support	Postdischarge care management including (1) care with an equal emphasis on physical and psychosocial health, (2) an advanced practice nurse care manager to assess patients' problems and coordinate care, (3) standardized assessments, education and interventions to ensure consistency in care targeting poststroke complications, (4) an interdisciplinary poststroke consultation team of stroke experts to devise and advise individual care plans, and (5) communication of assessments and care plan to each primary care physician and collaboration on with advanced practice nurse to support the team's evidence-based recommendations and patient goals.	Wagner's model of chronic illness care[41]
Andersen et al., 2000[42] Andersen et al., 2002[43]	Community-based support	Arm 1: Physician intervention consisting of three 1-hour home visits over 12 weeks focused on early detection and treatment of complications, maintenance of functional capacity, and psychological and social adjustment to a new life with stroke-related disability. Patients could call the project physician whenever they wished. Arm 2: Physiotherapist instruction and reeducation for 6 weeks after discharge in the patient's home to evaluate and address problems with indoor and outdoor mobility and some activities of daily living. Instruction and education for family and professional caregivers on how to maximize patient's function.	None reported
Ayana et al., 2001[44]	Community-based support	Patient-held record with telephone numbers of all relevant staff with space for therapist, patient, or family to record assessment and management decisions postdischarge (did not replace usual documentation) kept by each professional group.	None reported
Boter et al., 2004[45]	Community-based support	Nurse followup with standardized checklist on risk factors for stroke, consequences of stroke, and unmet needs for stroke services. Also a checklist for caregivers with special attention to the consequences the stroke has on caregivers' well-being. Interaction directed by needs. Patients/caregivers coached on self-management. Problems referred to general practitioner as needed.	None reported
Claiborne et al., 2006[46]	Community-based support	Integration of biopsychosocial interventions within a coordinated delivery of care (evidence-based health practices, proactive preventive treatment, and followup); monitor patient care and progress related to his or her biopsychosocial issues, service needs, and adherence to self-care practices; assess, assist, problem solve and coordinate service needs, for example, additional medical and related appointments, transportation issues, financial issues, housing needs, heating and repair assistance, equipment modification and assistance, employment issues, entitled services, and so forth; education, counsel and refer caregivers for support as needed.	None reported

Study	Type of intervention	Components	Theory
Donnelly et al., 2004[47]	Community-based support	Early discharge after home evaluation and assistive equipment in place. Team meetings at home with patient and family to discuss progress and goals.	None reported
Ertel et al., 2007[48] Glass et al., 2004[49]	Community-based support	Beginning early after onset of stroke, psychosocial intervention to mobilize the social networks of the stroke patient (including the primary caregiver, family, friends, and formal caregivers) during the postdischarge period to provide effective emotional and instrumental support, increase the patient's sense of self-efficacy regarding ability to regain function, maximize stress reduction, enhance effectiveness of problem solving. Home visits included intervention provider, patient, family and paid caregivers. Checklist used to confirm 16 content areas of psychosocial adaptation to stroke were identified.	Family systems theory and cognitive behavioral theory
Geddes et al., 2001[50]	Community-based support	Five intervention types met transition of care definition and all had a coordinator: the availability of multidisciplinary assessment and treatment; a patient-oriented approach to rehabilitation; the provision of help to caregivers; and the ability to address physical, psychological, and social aspects of rehabilitation.	None reported
Mayo et al., 2008[51]	Community-based support	Case management: for 6 weeks after discharge, a nurse stroke care manager was in contact with patients through home visits and telephone calls to coordinate care with the patient's personal physician and link the stroke survivor into community-based stroke services.	None reported
Ricauda et al., 2004[52]	Community-based support	Geriatric home hospitalization service included referral by general practitioners or physicians of hospital units, 24-hour rapid access to equipment needed for home nursing, multidisciplinary care, and admission if required in the hospital catchment area. Availability of a caregiver was necessary for participation in the program.	None reported
Torres-Arreola Ldel et al., 2009[53]	Community-based support	Nurse-led physical therapy plus education; started rehabilitation in the hospital and continued it at home after discharge and trained the caregiver and patient in general aspects of stroke and rehabilitation.	None reported
Joubert et al., 2006[54]	Chronic disease management	Support GPs to manage risk factors and detect and treat depression; personal contact between the specialist service (study neurologist) and the GP; telephone-tracking system provided ongoing information to the GP and gave patient and caregiver support; flowchart continuous surveillance and feedback while facilitating risk-factor management and providing feedback to the stroke service.	None reported

Study	Type of intervention	Components	Theory
Joubert et al., 2008[55]	Chronic disease management	Structured nurse-led telephone and physician office visit followup over 12 months; support to GPs to manage risk factors and detect and treat depression; personal contact between the specialist service (study neurologist) and the GP; telephone-tracking system provided ongoing information to the GP and gave patient and caregiver support; flowchart continuous surveillance and feedback while facilitating risk factor management and providing feedback to the stroke service.	None reported
Joubert et al., 2009[56]	Chronic disease management	Same as Joubert et al., 2008[55]	None reported

Abbreviations: GP = general practitioner

Table 4. Transition of Care Interventions and Models for Myocardial Infarction

Study	Type of intervention	Components	Theory
Eagle et al., 2005[57] Rogers et al., 2007[58]	Hospital-based preparation	Embedded the key priorities of the national guidelines into acute MI care.	None reported
Ho et al., 2007[59]	Hospital-based preparation	Inpatient and followup cardiology care in the Veterans Affairs hospital.	None reported
Kotowycz et al., 2010[60]	Hospital-based preparation	Early hospital discharge (48 to 72 hours) plus outpatient followup with an advanced practice nurse within 3 days of discharge and had ≥ 2 additional followups within 30 days of discharge; advanced practice nurse was to educate patients about the nature and management of their disease, with a focus on medications, and facilitation of discharge planning by ensuring patients were aware of all followup appointments and outpatient tests.	None reported
Petrie et al., 2002[61]	Hospital-based preparation	Brief psychological intervention to change inaccurate and negative illness perceptions of MI.	None reported
Young et al., 2003[62]	Hospital-based preparation	Four components of the disease management program were (1) the standardized pathway, labeled “the nursing checklist,” (2) the referral criteria for specialty care management, (3) the communication systems, including the discharge summary and the nurses’ visit report and (4) patient education. Patients were eligible to receive a minimum of six home care visits from a cardiac-trained nurse.	None reported
Mayou et al., 2002[63]	Patient/family education (hospital-based)	Individualized educational and behavioral, nurse-delivered cardiac rehabilitation program.	None reported

Study	Type of intervention	Components	Theory
Lacey et al., 2004[64]	Patient/family education (home-based)	Heart manual: rehabilitation and lifestyle information and advice, relaxation exercises and advice for patients and partners using audiotape, and an exercise plan to be followed according to individual ability. Support by a facilitator who provides contact by telephone or by face-to-face meeting during the first 6 weeks after acute MI.	None reported
Bambauer et al., 2005[65]	Community-based support	Six 30-minute telephone counseling sessions over a period of 8 weeks led by a doctoral-level clinician (psychiatrist, clinical psychologist, and/or internist) to address eight specific issues or fears, including loss of control, loss of self-image, dependency, stigma, abandonment, anger, isolation, and fear of death.	None reported
Costa e Silva et al., 2008[66]	Community-based support	Transdisciplinary care, multidisciplinary across specialties and settings with followup by cardiologist, endocrinologist, nurse and dietitian for up to 6 months.	None reported
Gallagher et al., 2003[67]	Community-based support	Support and information by a cardiac nurse to promote self-managed recovery and psychosocial adjustment beginning 1 to 2 days before hospital discharge, followed by 4 telephone calls at 2 to 3 days and 1, 3, and 6 weeks after discharge. Followup calls were scheduled to assist women coping with various stages of adjustment during recovery.	None reported
Hanssen et al., 2007[68] Hanssen et al., 2009[69]	Community-based support	Weekly nurse-initiated telephone calls were arranged for the first 4 weeks; subsequent calls were arranged 6, 8, 12, and 24 weeks after discharge to address individual needs and support of patients' own coping efforts with respect to lifestyle changes and risk-factor reduction.	Lazarus and Folkman[70] theory on stress, appraisal, and coping; also principles about patient education
Hall et al., 2002[71] Kovoor et al., 2006[72]	Community-based support	Early return to work at 2 weeks with phone contact once a week for 5 weeks by the nurse coordinator (and from economics center); 6 weeks in cardiac rehabilitation and no intervention contact until 6 months.	None reported
Luszczynska et al., 2006[73]	Community-based support	Implementation intention intervention program given on an individual basis and lasted10 to 15 minutes: Patients (1) received instructions about what implementation intention should include, (2) completed the intervention form, (3) screened the intervention form together with an interviewer and received supportive feedback from an interviewer regarding their implementation intentions, and (4) were complimented by an interviewer regarding successful implementation of their intentions.	None reported
Oranta et al., 2009[74]	Community-based support	Psychiatric nurse led interpersonal counseling program over six sessions (all by phone except last) including starting, encouragement, and ending phases.	None reported

Study	Type of intervention	Components	Theory
Robertson et al., 2001[75] Robertson et al., 2003[76]	Community-based support	Weekly home visit for 4 weeks after discharge by an experienced emergency and critical care nurse.	None reported
Sinclair et al., 2005[77]	Community-based support	Home visits at 1 to 2 weeks and 6 to 8 weeks after hospital discharge by a nurse who encouraged compliance with and knowledge of their treatment regimen, offered support and guidance about resuming daily activities, and involved other community services as appropriate.	None reported
Barlow et al., 2009[78]	Chronic disease management	Expert Patients Programme	None reported

Abbreviation: MI = myocardial infarction

Intervention type 1: hospital-based preparation for discharge to home. While the hospital-based models designed to prepare patients for discharge and the transition to home were generally described in detail, none of the six stroke models or the four MI models reported any theoretical foundation supporting the design of the intervention.

The components of four of the six interventions designed for stroke patients were similar.[15-21,32] These "extended stroke unit services" or "hospital-supported discharge" models each included a multidisciplinary team of professionals that followed the stroke patients as they transitioned home—and provided continued support, supervision, and coordination with community-level services. The timing and length of followup postdischarge varied, but the therapeutic foci on rehabilitation and continuity of care were similar across studies. The intervention described in Grasel et al.[22,23] differed in that it focused on the caregivers who provided psychoeducational education, training, and counseling prior to and after discharge from acute care for up to 3 months. The study by Sulch et al.[29-31] was the only stroke-specific intervention in this category that identified a single facilitator or lead interventionist—a stroke nurse, who in this study implemented an integrated-care pathway to improve coordination and discharge planning and reduce the length of stay. Although the integrated-care pathway was developed by a multidisciplinary team, the study investigators strategically chose a single lead interventionist so that the study would not be a burden for other disciplines. Unique to this category of hospital-based transition of care interventions for stroke patients, the study by Sulch et al. did not provide any postdischarge followup.

Each of the four MI models was distinctly different, but each shared at least one similarity with one of the hospital-based stroke interventions. Like Sulch et al., the study by Eagle et al. and Rogers et al.[57,58] tested a hospital-based program that in part aimed to improve care coordination and discharge planning but did not provide any posthospital followup as part of the intervention. Like the intervention in Grasel et al., the Petrie et al.[61] study was a psychological intervention, but it focused on patients' perceptions rather than on caregivers' perceptions. Interventions described by Ho et al.[59] and Young et al.[62] both straddled inpatient and outpatient or community-level care, but neither intervention was designed to support the handoff to community-based physicians or services. Also dissimilar from the stroke interventions in this category was the absence of a lead facilitator or specified team of professionals for any of the MI interventions. These components are depicted in Figure 4 as part of the taxonomy of MI and stroke transition of care interventions.

Intervention type 2: patient and family education interventions, both hospital-based and community-based. Seven patient and family education interventions were identified, with five for stroke patients and two for MI patients. Of these seven, three were based in the hospital (one MI, two stroke) and four were based in the community (one MI and three stroke). While the distinction was made between home-based and community-based to support the possibility of translation to practice for interventions found effective, it seemed less important to separate the two MI interventions from the five stroke interventions because the foundation of each was similar. Furthermore, the content of education included a myriad of topics but usually concentrated more heavily on either condition-specific information or psychosocial adaptation.

Collectively, the seven interventions can be stratified into three levels of complexity. At the most basic level, both Hoffman et al.[34] and Mayou et al.[63] tested structured education programs individualized for the patient and delivered by nurses. While Clark et al.,[33] Johnston et al.,[35]

Sahebalzamani et al.,[38] and Lacey et al.[64] also tested education programs, each also included patient followup by a nurse,[35,38] social worker,[33], or a "facilitator" that was not identified by discipline or training.[64] The study by Mant et al.[36,37] was the only intervention in this category that centered on information, support, and followup by a "family support organizer" and also extended the responsibilities of this role to serve as a liaison with other services. Very little detail was available on this intervention, and thus it could not be considered as a more advanced model of community-based support (intervention type 3).

Although the theoretical underpinnings of education programs are much more advanced and more commonly referred to than the theories supporting transition of care interventions, only two studies reported a theory guiding the intervention. Johnston et al.[35] reported a cognitive behavioral theory that applied more to the followup provided by nurses for guidance on coping skills and self-management. Clark et al.[33] described the applicability of family systems theory and how the family is a system both influenced by and influencing society and the individuals within or around the family unit. This theory seemed relevant for other interventions focused on the caregivers or the patient-caregiver dyad, but no other studies in this category of patient and family education reported its use.

Intervention type 3: community-based models of support. Of the 4 types of transition of care interventions, community-based models were most common (10 MI models and 13 stroke models). However, the variation among community-based models resulted in the creation of three subcategories: (1) provider-driven interventions, (2) psychosocial- or behavioral-focused interventions, and (3) technical support structures. Only 3 of 23 studies reported any theoretical or conceptual foundation.[39,40,48,49,68,69] Allen's advanced-practice nurse (APN) model was designed using Wagner's model of chronic illness care.[41] Family systems and cognitive behavioral theories were reported to support the stroke psychosocial intervention,[48,49] but no citation was provided for either theory. The nurse-led MI intervention by Hanssen et al.[68] used the theory on stress, appraisal, and coping.[70]

For conditions other than MI and stroke, provider-driven community-based models were most common and had the strongest evidence base.[9] They were also most common in this review of the literature, with half of the MI community-based models and 10 of 13 stroke models. These models generally identified one provider to serve as the care manager or coordinator facilitating a multifaceted intervention to support holistic health—targeting both physical and psychosocial needs and the transition in health status and physical location of care delivery. Followup or contact with the provider facilitating the intervention was, in some cases, structured and predetermined or was conducted as needed. Followup usually extended over only the short term, such as 1 to 3 months posthospitalization. Access to a larger multidisciplinary team was not uncommon, but purposeful coordination between acute and community-level care was not always a core component of the intervention.

Ten provider-driven structures were tested for stroke patients. Allen et al.[39,40] tested an APN model, and Mayo et al.[51] tested a nurse-led model. Boter et al.[45] also tested a nurse model but targeted both patients and their caregivers. Three models described in the article by Geddes et al.[50] were each led by a nurse; one was led by a physical therapist and an occupational therapist; and one was coordinated by both a nurse and a physical therapist. Torres-Arreola et al.[53] described a model that, instead of including nurses and physical therapists, included nurses trained to provide physical therapy. A team effort of nurses and physical therapists was used in the multidisciplinary early supported discharge model tested in Canada by Teng et al.[28]

The European early supported discharge models more commonly used a team approach without a designated lead coordinator or facilitator. The study by Holmqvist et al.[24] was an example of this team-led model. The hospital-at-home model by Ricauda et al.[52] also included a multidisciplinary team of professionals, but ultimately the intervention was led and managed by a physician, nurse, and physical therapist. Andersen et al.[42,43] tested a physician model and a less intense and rehabilitation-focused physiotherapist model. Donnelly et al.[47] also tested a simpler model focused on assistive equipment and goal setting facilitated by a team of professionals. The five MI provider-driven models varied little from the stroke models. Costa e Silva et al.[66] used a multidisciplinary team but followed patients for up to 6 months. Kotowycz et al.[60] used a more traditional APN model. Other studies by Hall et al.,[71] Kovoor et al.,[72] Robertson et al.,[75,76] and Sinclair et al.[77] used a nurse coordinator. The foci and intervention components were similar to the stroke models.

The psychosocial- and behavioral-focused community-based models were also provider driven. Of the two stroke studies, Ertel et al.[48] and Glass et al.[49] used a team approach to mobilize the patient's social network to facilitate adaptation after stroke, and Claiborne et al.[46] used a social worker–led model to facilitate both coordination of services and biopsychosocial needs. The psychosocial and behavioral interventions for MI were all single-provider driven and similar in length to the provider-driven models described above. The study by Bambauer et al.[65] was led over 8 weeks by a specialist—psychiatrist, psychologist, or internist. The study by Gallagher et al.[67] began in the hospital, extended 6 weeks after discharge, and was led by a cardiac nurse. The intervention in Oranta et al.[74] was held over six sessions and led by a psychiatric nurse, and the Hanssen et al.[68,69] study was also nurse-led but over 24 weeks if the patient needed the support.

The interviewer's background and training were not specified for the Luszczynska et al.[73] study, but the intervention was well described and was distinct and unique from the others. The behavior-change intervention was called "implementation intention" and was used to promote the adherence to guidelines for physical activity after MI. Proactive followup of study participants was not part of this specific model but instead added to evaluate change at 8 months.

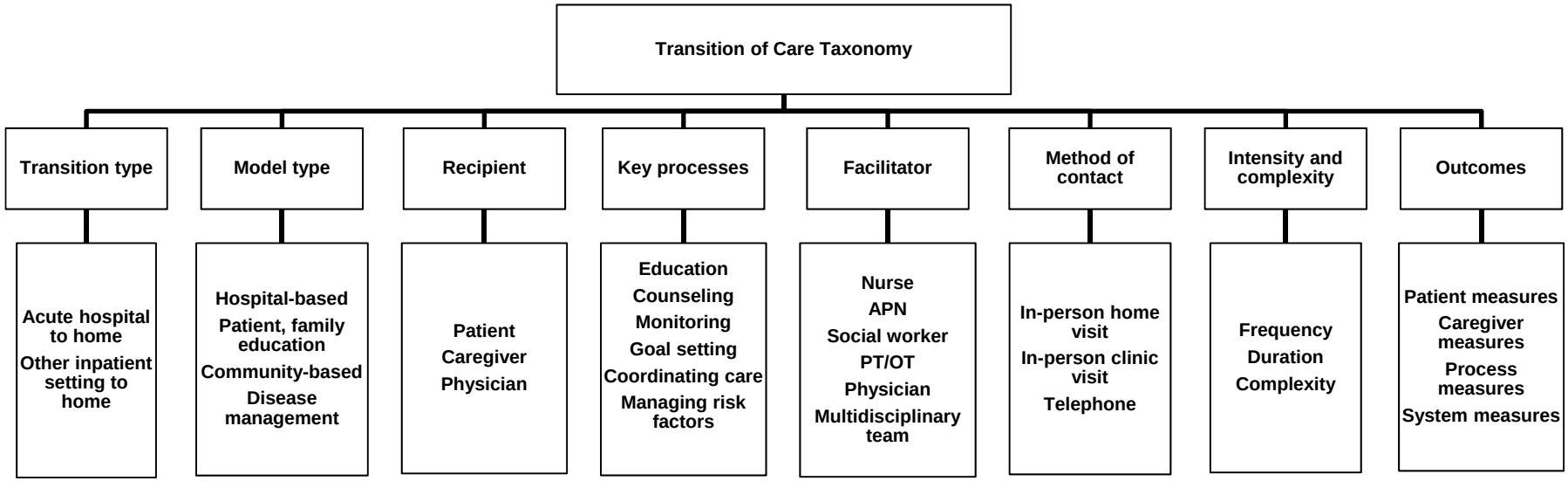
Only one technical structure was included in this review. Ayana et al.[44] tested a patient-held record that was ultimately the responsibility of the patient to use to improve communication across providers. No contact was made with the patient after the device was distributed through the completion of the study at 6 months, and other aspects of the transition of care were not evaluated. It is possible that other studies of this nature—testing a technical structure or a specific component of an intervention supporting the transition from hospital to home—were not identified in the literature review because of the keywords used in the literature search (see Appendix A).

Intervention type 4: chronic disease management models of care. Few chronic disease management models of care were identified for this review. This may be the case because chronic disease management models are more commonly designed for ambulatory conditions such as heart failure, diabetes, and depression, with the goal of managing risk factors and comorbid conditions, promoting self-management, and positively affecting change in specific laboratory values or adherence to medication regimens. However, one MI and three stroke models were included in this review because they had outcomes of interest and components of the model specifically addressed patient transitions. These models should be considered community-level interventions.

The MI model as described by Barlow et al.[78] tested an established chronic disease management program called the Expert Patient Programme—a "lay-led" community-based program—and compared this to cardiac rehabilitation. The three stroke studies,[54-56] on the other hand, were clinically designed to address areas similar to traditional chronic disease management models, but the structure of the intervention was more similar to a provider-driven community-based model of care. The studies of integrated care by Joubert et al.[54-56] were each nurse-led and had a lot of emphasis on the components facilitating continuity and coordination across providers and over the 12-month intervention. These components are again highlighted in the taxonomy below.

Taxonomy. Donabedian's framework of structure, process, and outcome—originally developed to examine health care quality—and other published taxonomies or frameworks for related interventions were used to guide the development of this taxonomy describing MI and stroke transition of care interventions.[10,79,80] Donabedian's framework is now more commonly used to define the characteristics of an intervention or model of care delivery (structure), the content and activities (process), and how these relate to and interact to influence outcomes. In Figure 4, we have similarly described the structure by depicting common subdomains of the type of transition, type of model, recipient of the intervention, and facilitator or lead personnel delivering the intervention. The process is described by highlighted key processes common across model types, the method of contact between the recipient and the facilitator, and the intensity and complexity of the intervention. The outcomes listed in the taxonomy are evaluated in KQs 2–5.

Figure 4. Taxonomy of Transition of Care Interventions for Stroke and MI



Abbreviations: APN = advanced practice nurse, MI = myocardial infarction, PT = physical therapist, OT = occupational therapist

Key Question 2

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)?

Key Points

- The summary of evidence for KQ 2 was built on results from the past 11 years of 34 articles in stroke and 19 articles in MI that involved 4146 patients with hemorrhagic or ischemic stroke and 11,070 patients with some form of cardiac disease.
- A variety of interventions considered transition of care for patients following stroke and MI; however, there was little consistency from study to study, making cross-study comparisons challenging.
- The most studied transition of care intervention was that of "early supported discharge" (intervention type 1). Early supported discharge after stroke was shown to be effective in reducing the total number of days spent in hospital while at the same time demonstrating that patient-related outcomes such as mortality, disability, and quality of life were no different than among patients treated with standard medical care. Early supported discharge after stroke was associated with increased patient and caregiver satisfaction.
- Guideline-based practice, disease management programs, and specialty followup after MI (intervention type 1) were associated with reduced length of stay, lower rehospitalization rates, and reduced mortality.
- There were no transition of care interventions that consistently improved functional outcomes after stroke.
- Early return to normal activities in low-risk post-MI patients was shown to be safe (intervention type 3).
- The most frequently cited comparator—usual care—was not well defined in the studies.
- There was much variability in the selection of outcome measures for evaluating the success of transitions.

Detailed Analysis

Literature identified. We identified 53 peer-reviewed articles (8 good quality, 36 fair, 9 poor) between 2000 and 2010 that were relevant to KQ 2. These 53 articles presented data from 40 studies that enrolled 15,216 patients: 4146 in the stroke subpopulation and 11,070 in the MI subpopulation (Table 5).

Table 5. Summary of Study Characteristics

Study	Population[a]	N	Intervention	Comparator	Outcomes (intervention group versus "other")[b]	Timing	Transition from setting	Transition to setting
Intervention type 1: Hospital-based preparation								
Askim et al., 2004[15]	Mixed stroke	62	Early supported discharge	Usual care	Barthel Index: p = .450 Caregiver strain: p = .832 mRS: p = .444 NHP: p = .918 Mortality: p = .534	1.5 mo 6 mo 12 mo	Hospital	Home
Askim et al., 2006[16]	Mixed stroke (study population[15])	62	Early supported discharge	Usual care	BBS: p = .440 Timed walk: p = .130	1.5 mo 6 mo 12 mo	Hospital	Home
Bautz-Holtert et al., 2002[17]	AIS only	82	Early supported discharge	Usual care	Death: OR = 2.2 (.3-25.7) EADL: p = .93 GHQ: p = .74 at 6 mo MADR: p = .30	3 mo 6 mo	Hospital	Home
Eagle et al., 2005[57]	MI only	2857	Guidelines applied in practice	Usual care	Mortality Hospital: 10.4%, p = .02 30 days: 16.7% vs 21.6%, p = .02 1 year: 33.2% vs 38.3%, p = .02	Hospital 30 day 1 year	Hospital	Home
Fjaertoft et al., 2003[18]	AIS only (study population[21])	320	Early supported discharge	Usual care	mRS: ≤ 2, 56.3% vs 45%, p = .045 Barthel Index: ≥ 95, 52.5% vs 46.3%, p = .264 Mortality: 13.1% vs 16.3%, p = .429	12 mo	Hospital	Home
Fjaertoft et al., 2004[19]	AIS only (study population[21])	320	Early supported discharge	Usual care	NHP: improved 78.9 vs 75.2, p = .048 Caregiver strain: improved 23.3 vs 22.6, p = .089 FAI: NS, p = .435 MADR: NS, p = .757 MMSE: NS, p = .498 NHP: improved	12 mo	Hospital	Home
Fjaertoft et al., 2005[20]	AIS only (study population[21])	320	Early supported discharge	Usual care	Length of stay: improved, p = .012	12 mo	Hospital	Home
Grasel et al., 2005[22]	Mixed stroke and caregivers	62 patients 62 caregivers	Intensified transition	Usual care	***Patient:*** AshSS: NS, p = .270 Barthel Index: NS, p = .968 FIM: NS, p = .129 SF-36 physical: NS, p = .270 SR 36 emotional: NS, p = .663 TUG: NS, p = .261 ***Caregiver:*** BSFC: NS, p = .980	6 mo	Inpatient rehabilitation	Home

Study	Population[a]	N	Intervention	Comparator	Outcomes (intervention group versus "other")[b]	Timing	Transition from setting	Transition to setting
Grasel et al., 2006[23]	Mixed stroke and caregivers (study population[22])	71	Intensified transition	Usual care	Institutionalized (2 vs 5) or deceased (4 vs 11) p = .010	31 mo	Inpatient rehabilitation	Home
Ho et al., 2007[59]	Mixed MI	4933	Specialty followup	Usual care	Death: 18.8 vs 22.1%, p = .009 Hazard ratio 0.73 (95%CI 0.62 to .87)	1 mo 3 mo	Hospital	Outpatient
Indredavik et al., 2000[21]	AIS only	320	Early supported discharge	Usual care	Barthel Index: ≥ 95, 60% vs 49%, p = .056 (OR = 1.54; 95% CI, .99 to 2.39) mRS: ≤ 2, 65% vs 52%, p = .017 (OR = 1.72; 95% CI, 1.10 to 2.70) Total hospital length of stay: 18.6 days vs 31.1 days, p = .0324 Mortality: 2.5% vs 4.4%, p = .3573	6 mo	Hospital	Home
Kotowycz et al., 2010[60]	MI only	54	Early supported discharge	Usual care	Compliance (rehab): no difference 55% vs 52%, p = .31 Compliance (meds): no difference, p > .30-.82 Death: no deaths Quality of life (SF-36): no difference, p >.05 Rehospitalization: no difference 8% vs 4%, p = .56	3 days 1 mo	Hospital	Home
Mayo et al., 2000[27]	Mixed stroke	114	Early supported discharge	Usual care	Barthel Index: NS IADL: improved Length of stay: improved SF-36 MCS: NS SF-36 PCS: improved TUG: NS	1 mo 3 mo	Hospital	Home
Rogers et al., 2007[58]	MI only	1368	Guidelines applied in practice	Usual care	Death: "significantly decreased 1-year mortality" in tertile 2 (OR 0.43, 95% CI: 0.22, 0.84) and tertile 3 (OR 0.45, 95% CI: 0.27,0.76)	12 mo	Hospital	Home
Sulch et al., 2000[29]	AIS only	152	Integrated (managed) care pathway	Usual care	Barthel Index: no difference, p >.05 Death: no difference, p >.05 Home: no difference, p >.05 Length of stay: no difference, p >.05 Quality of life (EuroQOL): worse 63 vs 72, p < .005	6 mo	Inpatient rehabilitation	Home
Sulch et al., 2002[31]	AIS only	152	Integrated-care pathway	Usual care	EQ-5D worse (72 vs 63), p < .005	6 mo	Inpatient rehabilitation	Home

Study	Population[a]	N	Intervention	Comparator	Outcomes (intervention group versus "other")[b]	Timing	Transition from setting	Transition to setting
Torp et al., 2006[32]	Mixed stroke	198	Early supported discharge	Usual care	Barthel Index: p = .89 Length of stay: p > .05 MD visit: p > .05 MMSE: p =.08 Patient satisfaction: p > .05 Rehospitalization: p > .05 SF-36: .43-.52	6 mo 12 mo	Hospital	Home
von Koch et al., 2001[26]	Mixed stroke (study population[24])	83	Early supported discharge	Usual care	Barthel Index: NS FAI: NS IADL: NS LMC: NS NPT: NS RAT: NS SIP: NS Timed walk: NS Hospitalization = improved (mean 18 vs 33 days, p = 0.002)	12 mo	Hospital	Home
Young et al., 2003[62]	MI only	146	Disease Management Program	Usual care	Rehospitalization: apparently improved (40 vs 80, statistical significance NR) Readmission days, all causes: improved (814 vs 483, p < 0.001) Emergency department visits: improved (147 vs 64, p < 0.001)	1 year	Hospital	Home
Intervention type 2a: Patient and family education (hospital-based)								
Hoffmann et al., 2007[34]	Mixed stroke	138	Computer-tailored stroke education	Usual care	COOP: no difference, p = .15-.97 HADS: anxiety worse -1.4, p = 0.03 Knowledge: no difference, p = .79 Patient satisfaction: improved, p = .003 Self-efficacy: no difference, p = .20-.64	3 mo	Hospital	Home
Lacey et al., 2004[64]	MI only	152	Self-help manual supported by facilitator	Usual care	Quality of life (EQ-5D): no difference .69 vs .65, p = .13 HADS depression: improved 4.26 vs 5.37, p = .01 HADS anxiety: improved 4.87 vs 6.60 p < .001	1.5 mo 6 mo	Hospital	Home

Study	Population[a]	N	Intervention	Comparator	Outcomes (intervention group versus "other")[b]	Timing	Transition from setting	Transition to setting
Mayou et al., 2002[63]	MI only	114	Guideline-based educational and behavioral cardiac rehabilitation	Usual care	COOP: NS at 1 mo HADS: NS at 1 mo COOP: improved at 3 mo (median difference, -3.09, p = 0.004) HADS: improved at 3 mo (median difference, -3.27, p = 0.002) COOP: NS at 12 mo HADS: NS at 12 mo	1 mo 3 mo 12 mo	Hospital	Home
Petrie et al., 2002[61]	MI only	65	Illness perception education	Usual care	ACS: improved (14% vs 39%, p < 0.05) IPQ: improved, p < 0.01 Patient satisfaction: improved, p < 0.05 Work: improved, p = 0.05	3 mo	Hospital	Home
Intervention type 2b: Patient and family education (home-based)								
Clark et al., 2003[33]	AIS only and caregivers	62	Stroke information packet and family counseling after discharge	Usual care	***Patient***: AAP: improved, p = .05 Barthel Index: improved, p = .05 GDS: NS HADS: NS Mastery scale: NS SF-36 patient: NS, p = .65 ***Caregiver***: FAD: improved, p = .001 SF-36 spouse: NS, p = -.16	6 mo	Hospital	Home
Johnston et al., 2007[35]	Mixed stroke and caregivers	203 patients 217 caregivers	Postdischarge education and followup	Usual care	***Patient***: Barthel Index: no difference F = .04, p > .05 HADS: no difference; F = .40, p > .05 OAD: -.17 vs .19; F 5.61, p = .019 Patient satisfaction: no difference F = .15, p > .05 Patient's confidence in recovery: improved p = .001 ***Caregiver***: Caregiver satisfaction: no difference, p > .05	6 mo	Hospital	Home
Intervention type 3: Community-based support								
Allen et al., 2002[39]	Mixed stroke	96	APN followup	Usual care	Barthel Index: NS CES-D: NS Death: NS Falls: NS NIHSS: NS SIP: improved Knowledge: improved	3 mo	Hospital or rehabilitation	Home

Study	Population[a]	N	Intervention	Comparator	Outcomes (intervention group versus "other")[b]	Timing	Transition from setting	Transition to setting
Allen et al., 2009[40]	AIS only	380	Post discharge care management	Usual care	CES-D: NS Death: NS Knowledge and lifestyle modification: improved, p = .003 Length of stay: NS NIHSS: NS Quality of life: NS TUG: NS	6 mo	Hospital	Home
Andersen et al., 2002[43]	Mixed stroke	155	Followup services (physician or physical therapist home visits)	Usual care	Barthel Index: NS, p = .165 Death: NS FAI: NS, p = .355 FQM: NS, p = .111 IADL: NS, p = .200	6 mo	Hospital	Home
Bambauer et al., 2005[65]	Mixed MI	100	Telephone counseling	Usual care	CGI-I: improved at 3 mo, p = .01 CGI-I: NS at 6 mo, p = .13	3 mo 6 mo	Hospital	Home
Barlow et al., 2009[78]	MI only	192	Expert Patient Program	Usual care	HADS anxiety: p = .016 HADS depression: p = .079 MIDAS: NS p ranges for all domains .153 to .808 SF-36 physical: p = .111 SF 36 mental: p = .497	4 mo	Home	Outpatient
Boter et al., 2004[45]	Mixed stroke	536	Telephone followup and home followup	Usual care	Barthel Index: N Diff. in means (95%CI) 0 (0 to 0) mRS: no difference in means (95%CI) 0 (-0.32 to 0.39) SASC (dissatisfaction with hospital care) RR 1.17 (0.82 to 1.68) SASC (dissatisfaction with home care) RR 1.07 (0.89 to 1.28)	6 mo	Hospital	Home
Claiborne et al., 2006[46]	AIS only	28	Social worker coordination services	Usual care	Compliance (self-care): improved, p < .05 GDS: improved, p < .001 SF-36 PCS: NS, p values NR SF-36 MCS: improved, p < .001	3 mo	Hospital	Home

Study	Population[a]	N	Intervention	Comparator	Outcomes (intervention group versus "other")[b]	Timing	Transition from setting	Transition to setting
Donnelly et al., 2004[47]	AIS only	113	Community-based stroke team	Usual care	Barthel Index: NS, p = .179 EADL: NS, p = .244 EQ-5D: NS, p = .604 Length of stay: NS Patient satisfaction: p = .017 Quality of life: NS, p = .581 SF-36 MCS: NS, p:.68 SF-36 PCS: NS, p = .799 Timed walk: NS, p = .335 Caregiver strain: NS, p = .927	12 mo	Hospital	Home
Ertel et al., 2007[48]	Mixed stroke	291	Home care cognitive behavioral therapy	Usual care	CSS: NS, p = .43 Death: NS, p = .91 IADL: NS, p = .89 PPT: NS, p = .86	6 mo	Hospital Inpatient rehabilitation	Home
Glass et al., 2004[49]	Mixed stroke (study population[48])	291	Psychosocial interventions	Usual care	Barthel Index: NS	6 mo	Hospital	Home
Hall et al., 2002[71]	MI only	142	Early return to normal activities	Usual care	No harm associated with early return to normal activities Quality of life: NS Work: NS	1.5 mo 3 mo 6 mo 12 mo	Hospital	Home
Hanssen et al., 2007[68]	MI only	288	Telephone followup	Usual care	PPT: frequency of exercise improved, p = .004 SF-36 MCS: p = .447 SF-36 PCS: improved by 2.33, p = .039	6 mo	Hospital	Home
Hanssen et al., 2009[69]	MI only (study population[68])	288	Telephone followup	Usual care	PPT: no difference in frequency of exercise at 12 mo, p = .593; or at 18 mo, p = .159 SF-36 MCS: no difference p = .280 SF-36 PCS: no difference p = .250	12 mo 18 mo	Outpatient	Home
Holmqvist et al., 2000[24]	Mixed stroke and caregivers	81 patients 63 caregivers	Home rehabilitation Early supported discharge	Usual care	*Patient:* Inpatient length of stay: 53% reduction (16 days) p < 0.001 Patient satisfaction: improved, p = 0.021 Rehospitalization: no difference, p = .392	6 mo	Hospital	Home
Kovoor et al., 2006[72]	MI only (study population[71])	142	Early return to normal activities with nurse coordinator weekly phone calls x 5 wk	Cardiac rehabilitation x 5 wk then return to work at 6 wk post-MI	Death: no deaths Reinfarction: no difference 2% vs 6%, p = .1 CABG: no difference 10% vs 3%, p = .08 Exercise: no difference, p = .12	1.5 mo 6 mo	Hospital	Home

Study	Population[a]	N	Intervention	Comparator	Outcomes (intervention group versus "other")[b]	Timing	Transition from setting	Transition to setting
Lusczynska et al., 2006[73]	MI only	114	Followup with implementation intervention program	Usual care	Physical activity levels maintained higher at 8 mo in patients using the program, p < .001	8 mo	Rehabilitation	Home
Mant et al., 2000[36]	Mixed stroke and caregivers	323 patients 267 caregivers	Family support	Usual care	***Patient:*** Barthel Index: no difference, p = .23 COOP: no difference, p = .08-.85 FAI: no difference, p = .66 HADS anxiety and depression: no difference, p = .12 and .46 Knowledge: no difference, p = .72 LHS: no difference, p = .98 Patient satisfaction: no difference, p = .60 RMI: no difference, p = .15 ***Caregiver:*** COOP: Quality of life better, p = .01 All other categories no difference, p = .12-.66 Caregiver satisfaction: NS Caregiver strain: no difference, p = .91 FAI: improved, p = .03 GHQ: no difference, p = .55 Knowledge: no difference, p = .61 SF-36 Energy and vitality better, p = .02 Mental health better, p = .004 Pain better, p = .03 Physical function better, p = .025 General health perception better, p = .02 Social function and role limitation no difference, p = .17-.67	6 mo	Hospital	Home

Study	Population[a]	N	Intervention	Comparator	Outcomes (intervention group versus "other")[b]	Timing	Transition from setting	Transition to setting
Mant et al., 2005[37]	Mixed stroke and caregivers (study population[36])	323 patients 267 caregivers	Family support	Usual care	***Patient*** Barthel Index: no difference, p= .06 COOP: no difference, p = .32-.92 FAI: no difference, p = .92 HADS anxiety and depression: no difference, p = .51, p = .92 LHS: no difference, p = .98 RMI: no difference, p = .17 ***Caregiver*** COOP: no difference, p =.06-.54 Caregiver strain: no difference, p =.37 FAI: no difference, p = .97 GHQ: no difference, p = .38 SF-36: Energy and vitality improved, p =.05 All other measures no difference, p =.07-.25	12 mo	Hospital	Home
Mayo et al., 2008[51]	Mixed stroke	190	Case Management: Followup and care coordination	Usual care	Barthel Index: NS EQ-5D: NS GDS: NS PBSI: NS RNLI: NS SF-36: NS TUG: NS Timed walk: NS	6 mo	Hospital	Home
Ricauda et al., 2004[52]	AIS only	120	Emergency department to home	Emergency department to ward	CNS: NS Death: NS FIM: NS GDS: improved (median 10 vs 17, p < 0.001) NIHSS: NS	6 mo	Emergency department	Home/ward
Robertson et al., 2001[75]	MI only	68	Home followup and education	Usual care	Rehospitalization: trend toward improvement (3 vs 7 patients), but statistical significance NR Cost: trend toward improvement, but statistical significance NR	1.5 mo	Hospital	Home
Robertson et al., 2003[76]	MI only (study population[75])	68	Home followup and education	Usual care	Rehospitalization: "major difference in re-hospitalisations … during the first 6 weeks, and a smaller but still substantial difference … during the 6 week to 6 month period" (statistical significance NR)	1.5 mo 6 mo	Hospital	Home

Study	Population[a]	N	Intervention	Comparator	Outcomes (intervention group versus "other")[b]	Timing	Transition from setting	Transition to setting
Sinclair et al., 2005[77]	Mixed MI	324	Home followup and education	Usual care	Death: NS IADL: NS Quality of life: NS Rehospitalization: improved (35 vs 51, RR 0.68, p < 0.05) Days of hospitalization after discharge: improved (mean difference -1.7, p < 0.05)	3 mo	Emergency	Home
Torres-Arreola Ldel et al., 2009[53]	AIS only	110	Physical therapy and caregiver education	Caregiver education only	Barthel Index: NS FAI: NS MMSE: NS	1 mo 3 mo 6 mo	Hospital	Home
Intervention type 4: Chronic disease management								
Costa e Silva et al., 2008[66]	MI only	153	Transdisciplinary care	Usual care	CII: NS p = 1.0 Compliance (diet): improved, p = .007 Compliance (meds): NS, p = 1.0 Compliance (followup): improved, p = .001 Death: NS, p = .250 Emergency department visits: NS, p = .742 PPT: NS Rehospitalization: NS, p = .168	6 mo	Hospital	Outpatient
Joubert et al., 2006[54]	Mixed stroke	97	Integrated care	Usual care	Depression. 20% vs 40%, p = .06 Activity (change in number of walks per week) p = .048	12 mo	Hospital	Home
Joubert et al., 2008[55]	Mixed stroke	233	Integrated care	Usual care	PHQ-9 (depression): improved 33% vs 55%, p = .003	12 mo	Hospital	Home
Joubert et al., 2009[56]	Mixed stroke (study population[55])	186	Integrated care	Usual care	Change in walks per week: .8 vs -.7, p < .001 mRS: >2 (disabled) improved 14% vs 33%, p = .003 Barthel Index: no difference 19.1 vs 17.8, p = .64 MMSE: no difference 21 vs 19, p = .97 Quality of life: improved 26.4 vs 29.7, p = .012	12 mo	Hospital	Home

[a]"Study population" cites the patient population from an earlier study.
[b]Instruments reported in the Outcomes column are full score or partial score as reported by the author.
Abbreviations: AAP = Adelaide Activities Profile, ACS = acute coronary symptoms, AIS = acute ischemic stroke, AshSS = Ashworth Spastic Scale, BBS = Berg Balance Scale, BSFC = Burden Scale for Family Caregivers, CABG = coronary artery bypass grafting, CGI-I = Clinical Global Impressions, CNS = Canadian Neurological Scale, CES-D = Center for Epidemiological Studies-Depression, CII = clinical improvement index, COOP = Dartmouth COOP, CSS = Cognitive Summary Score, EADL = Nottingham Extended Activities of Daily Living, EQ-5D = EuroQol 5 Dimensions, FAD = McMaster Family Assessment Device, FAI = Frenchay Activity Index, FIM = Functional Impairment Measure, FQM = Function Quality of Movement, GDS = Geriatric Depression Scale, GHQ = General Health Questionnaire, HADS = Hospital Anxiety and Depression Scale, IADL = Index of Activities of Daily Living, IPQ = Illness Perception Questionnaire, LHS = London Handicap Scale, LMC = Lindmark Motor Capacity, MADR = Montgomery Asberg Depression rating, MI = myocardial infarction, MIDAS = Myocardial Infarction Dimensional Assessment Scale, MMSE = Mini-Mental State Examination, mo = month/months, mRS = modified Rankin Scale, NHP = Nottingham

Health Profile, NIHSS = National Institutes of Health Stroke Scale, NPT = Nine-Hole Peg Test, NS = no statistically significant difference, OAD = Observer-Assessed Disability, OT = occupational therapy/therapist, PBSI = Preference-Based Stroke Index, PHQ = Patient Health Questionnaire Depression Model, PPT = physical performance test, PT = physical therapy/therapist, RAT = Reinvang Aphasia Test, RNLI = Reintegration to Normal Living Index, RMI = Rivermead Mobility Index, SAH = subarachnoid hemorrhage, SASC = Satisfaction with Stroke Care, Self = self-efficacy, SF-36 = Short Form-36, SF-36 MCS = Short Form-36 Mental Component Summary, SF-36 PCS = Short Form-36 Physical Component Summary, SIP = Sickness Impact Profile, SNA = service needs assessment, SRH = Self-Rated Health, TUG = Timed Up and Go, ZDS = Zerssen Depression Scale

Population. The population of interest was the set of patients with vascular disease resulting in AIS, intracerebral hemorrhage (ICH), or MI. Study populations were categorized into four population cohorts (shown in Table 5) as follows. The AIS-only cohort included studies in which the sample was limited to patients with ischemic stroke. The mixed-stroke cohort included studies that enrolled patients with both ischemic and hemorrhagic stroke. Studies limited to patients presenting with transient ischemic attacks (TIAs) were not included in this review as most patients with TIA are not hospitalized, and establishing a definitive diagnosis of TIA is often problematic, thus introducing potential ascertainment bias into the conclusions drawn from the study. The MI-only cohort included studies in which the sample was limited to acute MI or unstable angina. The mixed-MI cohort included studies that enrolled patients with multiple cardiac diagnoses, where at least one diagnostic category was acute MI or unstable angina.

From the original 53 articles, 13 studies[17-21,29,31,33,40,46,47,52,53] included only patients with acute ischemic stroke (AIS only), 16 studies[57,58,60-64,66,68,69,71-73,75,76,78] included only patients with MI (MI only), 21 studies[15,16,22-24,26,27,32,34-37,39,43,45,48,49,51,54-56] included patients with AIS, ICH, and subarachnoid hemorrhage or did not define stroke as ischemic/hemorrhagic (mixed stroke), and 3 studies[59,65,77] included patients with MI or ACS and other cardiac diseases (mixed MI). There were no studies that explored transition interventions for patients diagnosed only with ICH/SAH. The final sample of 15,216 patients included 1367 patients in the AIS-only cohort, 5713 patients in the MI-only cohort, 2779 patients in the mixed-stroke cohort, and 5375 patients in the mixed-MI cohort.

Six articles[22,24,33,35-37] reporting on five distinct studies enrolled the patient and the caregiver. In these studies, there was no attempt to describe a dyadic relationship; rather, they described the effect of the intervention on separate outcomes for patient and caregiver. The caregiver population was predominately female (70.6%) and most often described as spouse or partner (89.6%) (Table 6). The patient population for each study was stroke—none of the MI studies included in this analysis enrolled caregivers.

Table 6. Relationship of Caregivers to Patients

Study	Population	N[a]	Spouse	Partner	Child	Other	Female
Clark et al., 2003[33]	AIS only	62	100%				61.3%
Grasel et al., 2005[22]	Mixed stroke	62		71%	22.6%	6.5%	74.2%
Holmqvist et al., 2000[24]	Mixed stroke	81	77.8%	69.1%	8.6%[b]		46.9%
Johnston et al., 2007[35]	Mixed stroke	217					79.3%
Mant et al., 2000[36] and 2005[37]	Mixed stroke	267	65.2%	24%	10.9%		67.4%
Sulch et al., 2002[31]	AIS only	152					

[a]N reflects number of patients in the primary study; not all patients in a study had caregiver support.
[b]Sex not reported
Abbreviation: AIS = acute ischemic stroke

Interventions and Comparators. There was a wide range of interventions described in these studies. By far, the most common type of intervention could be broadly described as early supported discharge (ESD) (see KQ 1 for the taxonomy of intervention programs). Key elements that emerged in the interventions included the use of inpatient or outpatient rehabilitation, patient and caregiver followup, patient and caregiver education, providing patients with specialty physician consults, and coordination of care delivery services. These elements were typically addressed in studies that defined the intervention as ESD.[15,17,24,27,32,47,51] In addition to ESD, studies described intervention programs developed under umbrella titles such as extended stroke unit services (ESUS),[21] and guidelines applied in practice (GAP).[57,58]

Table 7 shows that—with the exception of those studies described above (each of which used a developed program)—there was a range of intervention approaches. A modification to the usual approach for rehabilitation (including inpatient, outpatient, or variations in delivery) was used as a component of eight different studies.[31,40,43,52,53,63,64,71] Some form of patient followup was utilized in 24 (60%) studies.[22,27,33,35,39,40,43,45,46,48,52,54,55,59-63,65,66,68,73,75,77] Education was used in 27 (67.5%) studies.[22,31,33-36,39,40,43,45,46,48,53-55,60,61,63,64,68,71,73,75,77,78] Eleven (27.5%) studies[22,31,39,40,46,52,54,55,60,62,72] reported that coordinating some aspect of care delivery was part of the intervention, and five (12.5%) studies[22,39,40,54,55] reported that consulting (providing consult to) a specialist was a component of the intervention.

Table 7. Transition of Care Interventions

Study[a]	Population	Program[b]	Rehab[c]	Followup[d]	Education[e]	Coordinate[f]	Consult[g]
Allen et al., 2002[39]	Mixed stroke			X	X	X	X
Allen et al., 2009[40]	AIS only		X	X	X	X	X
Andersen et al., 2002[43]	Mixed stroke		X	X	X		
Askim et al., 2004[15]	Mixed stroke	ESD					
Bambauer et al., 2005[65]	Mixed MI			X			
Barlow et al., 2009[78]	MI only				X		
Bautz-Holtert et al., 2002[17]	AIS only	ESD					
Boter et al., 2004[45]	Mixed stroke			X	X		
Claiborne et al., 2006[46]	AIS only			X	X	X	
Clark et al., 2003[33]	AIS only			X	X		
Costa e Silva et al., 2008[66]	MI only			X			
Donnelly et al., 2004[47]	AIS only	ESD					
Eagle et al., 2005[57]	MI only	GAP					
Ertel et al., 2007[48]	Mixed stroke			X	X		
Grasel et al., 2005[22]	Mixed stroke			X	X	X	X
Hall et al., 2002[71]	MI only		X		X		
Hanssen et al., 2007[68]	MI only			X	X		
Ho et al., 2007[59]	Mixed MI			X			

Study[a]	Population	Program[b]	Rehab[c]	Followup[d]	Education[e]	Coordinate[f]	Consult[g]
Hoffmann et al., 2007[34]	Mixed stroke				X		
Holmqvist et al., 2000[24]	Mixed stroke	ESD					
Indredavik et al., 2000[21]	AIS only	ESUS					
Johnston et al., 2007[35]	Mixed stroke			X	X		
Joubert et al., 2006[54]	Mixed stroke			X	X	X	X
Joubert et al., 2008[55]	Mixed stroke			X	X	X	X
Kotowycz et al., 2010[60]	MI only			X	X	X	
Kovoor et al., 2006[72]	MI only					X	
Lacey et al., 2004[64]	MI only		X		X		
Lusczynska et al., 2006[73]	MI only			X	X		
Mant et al., 2000[36]	Mixed stroke			X	X		
Mayo et al., 2000[27]	Mixed stroke	ESD					
Mayo et al., 2008[51]	Mixed stroke	ESD					
Mayou et al., 2002[63]	MI only		X	X	X		
Petrie et al., 2002[61]	MI only			X	X		
Ricauda et al., 2004[52]	AIS only		X	X		X	
Robertson et al., 2001[75]	MI only			X	X		
Rogers et al., 2007[58]	MI only	GAP					
Sinclair et al., 2005[77]	Mixed MI			X	X		
Sulch et al., 2000[29]	AIS only		X		X	X	
Torp et al., 2006[32]	Mixed stroke	ESD					
Torres-Arreola Ldel et al., 2009[53]	AIS only		X		X		
Young et al., 2003[62]	MI only			X		X	

[a]Articles cited in the table Study Characteristics (Table 5) that are secondary or followup data analyses of an earlier study are not included in this table.
[b]Program options indicate a developed or systems-based intervention.
[c]Rehab indicates that patients received some form of rehabilitation as part of the intervention.
[d]Followup refers to any activity where medical staff provides followup care after discharge.
[e]Education indicates that there was ample evidence that patient or caregiver education was part of the intervention.
[f]Coordinate indicates that at least one component of the intervention was the coordination of care services for patient after discharge.
[g]Consult indicates that as part of the intervention, staff were instructed to facilitate a consult to general practitioners or specialists.
Abbreviations: Abbreviation: AIS = acute ischemic stroke, ESD = early supported discharge, ESUS = extended stroke unit services, GAP = guidelines applied in practice, MI = myocardial infarction

The intervention group was most often defined as receiving some intervention in addition to receiving the usual care. In all but two studies, the comparator was defined as usual care.[52,53] Table 8 shows, however, that when usual care was the default comparator, the description of usual care was generally confined to a few aspects of care. The majority of studies (52.5%) [21,22,24,27,33,35,36,39,45,46,48,51,54,55,57-59,61,73,77,78] gave either no real description of usual care or did not addressed key elements of usual care. There were 5 studies[15,17,40,47,66] that listed some form of

acute care as usual care, and 10 studies[15,31,32,40,43,47,62,64,71,72] added rehabilitation. Some form of patient followup was cited as usual care in seven studies.[32,43,60,62,63,68,75] Five studies[34,40,63,65,71] documented education as usual care, whereas seven studies[15,31,32,40,60,62,66] included coordination of care delivery as a component of usual care.

Table 8. Elements of Usual Care

Study[a]	Not reported[b]	Acute care[c]	Rehabilitation[d]	Followup[e]	Education[f]	Coordination[g]
Allen et al., 2002[39]	X					
Allen et al., 2009[40]		X	X		X	X
Andersen et al., 2002[43]			X	X		
Askim et al., 2004[15]		X	X			X
Bambauer et al., 2005[65]					X	
Barlow et al., 2009[78]	X					
Bautz-Holtert et al., 2002[17]		X				
Boter et al., 2004[45]	X					
Claiborne et al., 2006[46]	X					
Clark et al., 2003[33]	X					
Costa e Silva et al., 2008[66]		X				X
Donnelly et al., 2004[47]		X	X			
Eagle et al., 2005[57]	X					
Ertel et al., 2007[48]	X					
Grasel et al., 2005[22]	X					
Hall et al., 2002[71]			X		X	
Hanssen et al., 2007[68]				X		
Ho et al., 2007[59]	X					
Hoffmann et al., 2007[34]					X	
Holmqvist et al., 2000[24]	X					
Indredavik et al., 2000[21]	X					
Johnston et al., 2007[35]	X					
Joubert et al., 2006[54]	X					
Joubert et al., 2008[55]	X					
Kotowycz et al., 2010[60]				X		X
Kovoor et al., 2006[72]			X			
Lacey et al., 2004[64]			X			
Lusczynska et al., 2006[73]	X					
Mant et al., 2000[36]	X					
Mayo et al., 2000[27]	X					
Mayo et al., 2008[51]	X					
Mayou et al., 2002[63]				X	X	
Petrie et al., 2002[61]	X					
Robertson et al., 2001[75]				X		
Rogers et al., 2007[58]	X					
Sinclair et al., 2005[77]	X					
Sulch et al., 2000[29]			X			X
Torp et al., 2006[32]			X	X		X
Young et al., 2003[62]			X	X		X

[a]Articles cited in the Study Characteristics (Table 5) that are secondary or followup data analyses of an earlier study are not included in this table.
[b]The authors did not report a definition of "usual care."

[c]Acute care refers to any level of specialty care (e.g., stroke unit, cardiac care unit).
[d]Rehabilitation includes inpatient and outpatient rehabilitation.
[e]Followup includes patient followup (telephone, in-person, office visit) and any form of care delivered in the home setting (e.g., nursing care, rehabilitation).
[f]Education refers to any form of formal education plan focused on facilitation the transition of care.
[g]Coordination refers to any form of care coordination (e.g., discharge planning, physician referral).

Two studies[52,53] that did not use the comparator of usual care were stroke studies. The study by Ricauda et al.[52] explored transitioning stroke patients from the emergency department (ED) to home and used the "ED-to-ward" comparator. It was unclear if ED-to-ward equated with usual care given that it is not unexpected that a proportion of patients having a TIA would be discharged home directly from the ED. Here, the distinction was important given that there were three major options for rehabilitation (inpatient, outpatient, and home care) and neither is considered the gold standard. Torres-Areola Ldel et al.[53] explored an education intervention in conjunction with physical therapy and compared this against an education-only cohort.

Outcomes. We identified more than 70 distinctly different outcome measures that were used to evaluate the relationship between transition of care services and impairments, functional status, quality of life, mortality, health care utilization, and family/caregiver burden. The majority of measures (n = 60) were measures that were validated or reported in prior studies or that could be classified as objective or physiological measures. Table 9 lists the reported outcome assessment measures grouped by category.

Table 9. Outcome Assessment Measures

Outcome Assessment Measures
Impairments
Any measure of acute coronary symptoms (ACS)
Ashworth Spastic Scale (AshSS)
Canadian Neurological Scale (CNS)
Center for Epidemiological Studies of Depression scale (CES-D)
Cognitive Summary Score (CSS)
Geriatric Depression Scale (GDS)
Hospital Anxiety and Depression Scale (HADS)
Mini-Mental State Examination (MMSE)
Montgomery Asberg Depression Rating (MADR)
National Institutes of Health Stroke Scale (NIHSS)
Patient Health Questionnaire Depression (PHQ)
Psychosocial assessment
Reinvang Aphasia Test (RAT)
Zerssen Depression Scale (ZDS)
Functional status
Adelaide Activities Profile (AAP)
Any measure of compliance
Any measure of physical performance test (PPT)
Any measure of return to work
Barthel Index
Berg Balance Scale (BBS)
Clinical improvement index (CII)
Dartmouth COOP charts (COOP)
Frenchay Activity Index (FAI)
Functional Impairment Measure (FIM)
Function Quality of Movement (FQM)
Instrumental of Activities of Daily Living (IADL)
Lindmark Motor Capacity (LMC)

Outcome Assessment Measures
Myocardial Infarction Dimensional Assessment Scale (MIDAS)
Nine-Hole Peg Test (NHP)
Observer-Assessed Disability (OAD)
Nottingham Extended Activities of Daily Living (EADL)
Rivermead Mobility Index (RMI)
Timed walk
Timed Up and Go (TUG)
Quality of life
Clinical Global Impressions (Improvement subscale) (CGI-I)
EuroQol 5 Dimensions (EQ-5D)
General health questionnaire (GHQ)
Illness Perception Scale (IPQ)
London Handicap Scale (LHS)
Nottingham Health Profile (NHP)
Reintegration to Normal Living Index (RNLI)
Self-Rated Health (SRH)
Short Form-36 (SF-36)
Short Form-36 Mental Component Summary (SF-36 MCS)
Short Form-36 Physical Component Summary (SF-36 PCS)
Sickness Impact Profile (SIP)
Mortality
Deaths
Health care utilization
Any measure of cost of care
Any measure of length of hospital stay
Any patient-physician scheduled appointment
Any measure of patient location
Any readmission or rehospitalization
Emergency department visits
MD visit
Family or caregiver
Burden Scale for Family Caregivers (BSFC)
Caregiver satisfaction
Caregiver strain index
McMaster Family Assessment Device (FAD)
Patient satisfaction
Satisfaction with care
Other
Any measure of illness-related knowledge

There were no universally beneficial or universally harmful transition interventions (Table 10). Most interventions had mixed effects on outcomes, with some outcomes demonstrating benefit and others showing no change or worsening. Based on the preponderance of the evidence reviewed we were able to draw a number of conclusions about the effectiveness of each intervention when applied during one of the 4 phases of transition of care as defined in our model.

At the stage of hospital-based preparation for discharge, “early supported discharge” was shown in 8 studies[17-21,23,24,26] to reduce total hospital length of stay and improve patient satisfaction while there did not appear to be any adverse effects associated with it such as altered mortality, functional disability, or quality of life.[15-19,21,22,26,27,32] We were able to find only a single study that evaluated “early supported discharge” following MI,[60] and that trial did not demonstrate any benefits to the patients or their caregivers. Guideline-based practice and disease management programs following MI were shown to decrease death and rehospitalization; however, this conclusion is based on only three moderate-sized studies.[57,58,62]

Hospital-based as well as community-based patient and family education programs were able to increase patient satisfaction,[34] reduce anxiety and depression in some cases[61,63,64] as well as increase patient confidence in gaining recovery;[35] however, the findings were not always consistent.[33,35,63,64] There was no community-based support program that consistently improved either patient or family well-being, whether that program was staffed by nurses, physical therapists, social workers or physicians (Table 10).

One program that seemed to show promise was that of allowing patients with MI and a low-risk profile to return to normal activities early while being followed by weekly phone calls, without having to go through the standard 5-week cardiac rehabilitation program.[71,72] This program was not associated with any increase in mortality, reinfarction, or requirement for future coronary bypass surgery. Patients in that program were able to return to work at the same rate as the control subjects. Risk factor control was also the same between the two groups. Telephone-based supportive followup did not demonstrate consistent benefits when evaluated after MI.[68,69] Guideline-based practice[57,58] and specialty care followup after MI were associated with reduced mortality.[59] We did not find any chronic disease transition of care interventions that produced consistent improvement in outcomes or risk factor modification.[54-56,66]

Table 10. Evidence Supporting Specific Components of Transition of Care Interventions

Population	Specific transition of care intervention	Total # of studies demonstrating benefit	Endpoints with improvement	Total # of studies demonstrating no benefit	Endpoints without improvement
Intervention type 1: Hospital-based preparation					
Stroke patients	Early supported discharge	8[17-21,23,24,26]	Death mRS NHP Length of stay Patient satisfaction Institutionalization IADL	10[15-19,21,22,26,27,32]	Barthel Index mRS NHP Death BBS Timed walk EADL GHQ MADR FAI MMSE AshSS FIM SF-36 TUG Rehospitalization MD visits
	Integrated-care pathway	0		2[29,31]	Barthel Index Death Length of stay EQ-5D
Stroke patients' caregivers	Early supported discharge	1[19]	Caregiver strain	3[15,19,22]	Caregiver strain BSFC
MI patients	Early supported discharge	0		1[60]	Medication compliance Death SF-36 Readmission
	Guideline-based practice	2[57,58]	Death	0	
	Disease management program	1[62]	Rehospitalization Emergency department visits Readmission length of stay	0	
	Specialty followup	1[59]	Death	0	
MI patients' caregivers	No studies				

Population	Specific transition of care intervention	Total # of studies demonstrating benefit	Endpoints with improvement	Total # of studies demonstrating no benefit	Endpoints without improvement
Intervention type 2a: Patient and family education (hospital-based)					
Stroke patient	Computer-tailored stroke education	1[34]	Patient satisfaction	1[34]	COOP Knowledge Self-efficacy HADS anxiety (worsened)
Stroke patients' caregivers	No studies				
MI patients	Illness perception education	1[61]	ACS IPQ Patient satisfaction Work	0	
	Guideline-based education	1[63]	COOP:3 mo HADS: 3 mo	1[63]	HADS: 12 mo COOP: 12 mo
	Self-help manual	1[64]	HADS depression HADS anxiety	1[64]	EQ-5D
Intervention type 2b: Patient and family education (home-based)					
Stroke	Stroke information packet and family counseling	1[33]	AAP Barthel Index FAD	1[33]	GDS HADS Mastery scale SF-36 patient SF-36 spouse
	Postdischarge education and followup	1[35]	OAD Patient confidence in recovery	1[35]	Barthel Index HADS Patient satisfaction Caregiver satisfaction
Intervention type 3: Community-based support					
Stroke	Postdischarge care management or home followup	2[39,40]	SIP Knowledge	3[39,40,51]	Barthel Index, CES-D Death Falls NIHSS Length of stay TUG Quality of life FAI FQM IADL

Population	Specific transition of care intervention	Total # of studies demonstrating benefit	Endpoints with improvement	Total # of studies demonstrating no benefit	Endpoints without improvement
	Family support, community-based stroke team	3[27,37,47]	SF-36 energy and vitality SF-36 quality of life improved in caregiver Patient satisfaction	3[27,37,47]	Barthel Index COOP-patient COOP-caregiver FAI-caregiver HADS LHS RMI GHQ-caregiver Caregiver strain EQ-5D Length of stay SF-36 MCS SF-36 PCS Timed walk
	Telephone counseling	1[65]	CGI-I: 3 mo	2[45,65]	CGI-I: 6 mo Barthel Index mRS HADS SASC SF-36
	Expert Patient Programme	0		1[78]	HADS anxiety HADS depression MIDAS SF-36 MCS SF-36 PCS
	Social worker, psychosocial interventions	1[46]	Self-care compliance GDS SF-36 MCS	2[46,49]	Barthel Index SF-36 PCS
	Home care cognitive therapy	0		1[48]	CSS Death IADL Physical exercise
MI	Early return to normal activity	2[71,72]	No harm experienced (no difference in mortality, reinfarction, bypass surgery, quality of life and work)	1[72]	Exercise
	Telephone followup	1[68]	Improved exercise SF-36 PCS	2[68,69]	Exercise SF-36 MCS SF-36 PCS
	Implementation intervention program	1[73]	Increased physical activity	0	

Population	Specific transition of care intervention	Total # of studies demonstrating benefit	Endpoints with improvement	Total # of studies demonstrating no benefit	Endpoints without improvement
	Home followup and education	2[55,77]	Rehospitalization Depression (PHQ-9)	3[75-77]	Rehospitalization Death IADL
Intervention type 4: Chronic disease management					
Stroke	Integrated care	3[54-56]	Depression (PHQ-9) Activity mRS Quality of life	2[54,56]	Barthel Index Depression MMSE
MI	Transdisciplinary care	1[66]	Diet compliance Medical followup compliance	1[66]	Medication compliance CII Death Exercise Rehospitalization Emergency department visits

Abbreviations: AAP = Adelaide Activities Profile, ACS = acute coronary symptoms, AIS = acute ischemic stroke, AshSS = Ashworth Spastic Scale, BBS = Berg Balance Scale, BSFC = Burden Scale for Family Caregivers, CGI-I = Clinical Global Impressions, CES-D = Center for Epidemiological Studies-Depression, CII = clinical improvement index, COOP = Dartmouth COOP, CSS = Cognitive Summary Score, EADL = Nottingham Extended Activities of Daily Living, EQ-5D = EuroQol 5 Dimensions, FAD = McMaster Family Assessment Device, FAI = Frenchay Activity Index, FIM = Functional Impairment Measure, FQM = Function Quality of Movement, GDS = Geriatric Depression Scale, GHQ = General Health Questionnaire, HADS = Hospital Anxiety and Depression Scale, IADL = Index of Activities of Daily Living, IPQ = Illness Perception Questionnaire, LHS = London Handicap Scale, LMC = Lindmark Motor Capacity, MADR = Montgomery Asberg Depression rating, MI = myocardial infarction, MIDAS = Myocardial Infarction Dimensional Assessment Scale, MMSE = Mini-Mental State Examination, mo = month/months, mRS = modified Rankin Scale, NHP = Nottingham Health Profile, NIHSS = National Institutes of Health Stroke Scale, NS = no statistically significant difference, OAD = Observer-Assessed Disability, PBSI = Preference-Based Stroke Index, PHQ = Patient Health Questionnaire Depression Model, PPT = physical performance test, RMI = Rivermead Mobility Index, SASC = Satisfaction with Stroke Care, SF-36 = Short Form-36, SF-36 MCS = Short Form-36 Mental Component Summary, SF-36 PCS = Short Form-36 Physical Component Summary, SIP = Sickness Impact Profile, TUG = Timed Up and Go

Of the 53 articles included in the analysis for KQ 2, six reported universal benefit to patients who received the intervention (Table 10)—one in the stroke cohort,[55] and five in the MI cohort.[59,61,62,64,73] The single study[55] in the stroke cohort included 29 patients and concluded that integrated care reduced depressive symptoms. In total, the 5 MI cohort studies included 5410 patients. In a study of 4933 MI patients, Ho et al.[59] found that a reduction in mortality was associated with transition to specialty care followup. The remaining MI cohort studies explored education interventions;[61,64] followup interventions;[73] a disease-management protocol;[62] and benefits to patients in reducing depression (Hospital Anxiety and Depression Scale [HADS], EuroQOL 5 Dimensions [EQ-5D]),[64] improving health,[61,73] and increasing satisfaction and returning to work earlier with fewer physical symptoms associated with their illness.[61,62]

A majority of the studies in the stroke cohort[15-24,27,33,35,39,40,46,54,56,63,65,68,69] found mixed results and reported some area of benefit to patients who received the intervention but also found areas of no difference in outcomes for patients who received the intervention versus those who did not. In the stroke cohort, five articles[17,63,65,68,69] from four studies reported mixed positive and null results at different time points (Table 10). Three of these studies[17,63,65] initially showed a benefit to the transition intervention at 3 months after discharge that did not remain statistically significant at the 6-month or 12-month measure. However, Bambauer et al.[65] found that the intervention had sustained improvement in depression (HADS) and self-rated health scores. Hanssen et al.[68,69] found early benefit to a followup intervention at 6 months (improved quality-of-life and SF-36 physical component summary [PCS] scores) that did not remain significant at 12 and 18 months after discharge.

Including all 53 articles relevant to KQ 2, a beneficial effect from the intervention was noted in 35 of the 71 outcomes reported. While nine outcome measures—knowledge, Geriatric Depression Scale, HADS, length of stay, modified Rankin Scale, patient satisfaction, physical performance test, quality of life, and SF-36 PCS—were found by more than one study to benefit from the intervention, each of these measures was also reported as not being significantly impacted by the intervention.[15,18,20,21,24,27,32-37,40,45-48,51,52,54,56,60,61,63-66,68,69,72,73,77,78] The most commonly reported measure was the SF-36 (or SF-36 components), which was reported in 12 studies.[22,27,32,33,45-47,51,58,68,69,78] Three studies reported any level of improved SF-36 component scores,[27,46,68] and no study reported an overall improvement in SF-36 scores. One study[68] found that the intervention resulted in improved SF-36 mental component summary (MCS) scores at 3 months following stroke discharge. One study[69] reported improved SF-36 PCS scores at 6 months after stroke but not at 12 or 18 months after stroke. Mayo et al.[27] reported improved SF-36 PCS scores at 1 and 3 months after stroke but no change in SF-36 MCS scores for this period.

There were 15 studies in which the authors found neither benefit nor harm for patients assigned to receive the transition intervention—10 in the stroke cohort,[26,29,32,36,37,43,45,47,48,51,53] and 5 in the MI cohort.[57,58,60,72,75,76,78] The 10 stroke cohort studies explored 8 different interventions and 35 different outcome measures with no significant differences in groups (Table 10).

There were three articles from two studies[29,31,34] that concluded some form of harm as a result of the intervention. In a study of 138 stroke patients, Hoffmann et al.[34] found that a computer-tailored stroke education intervention resulted in worse depression (HADS) but improved patient satisfaction for the intervention group; there was no difference in Dartmouth COOP scores, knowledge of stroke, or self-efficacy. Sulch et al.[29,31] also found that depression scores were worse for the intervention group in their study of 152 stroke patients. Patients who were treated with an integrated-care pathway were also found have lower quality-of-life and

Barthel Index scores compared to their counterparts.[29] There were no major negative outcomes reported in the MI cohort studies.

The impact of the intervention on the caregiver was explored in a small portion of the stroke studies and none of the MI studies. There was insufficient evidence in these studies to demonstrate an adverse response or benefit to the quality of life and functional status of the caregiver. Two studies[33,36] demonstrated a relationship between the transition intervention and caregiver outcomes. Clark et al.[33] found that an intervention of education and family counseling improved family functioning at 6 months but that that there was no change in SF-36 scores for the caregiver. The first study by Mant et al.[36] reported a significant improvement in the instrumental activities of daily living for caregivers (reported as improved scores in Frenchay Activity Index [FAI]) but found no change in caregiver satisfaction, strain, GHQ, COOP, or SF-36 scores. In a followup study, Mant et al.[37] found no change in FAI scores or in caregiver satisfaction, strain, GHQ, COOP, or SF-36 scores. In the remaining studies, the interventions had no significant impact on caregiver burden,[22,29] satisfaction,[29,35] symptoms (e.g., Giessen Symptom List[22] and SIP[24]), or depression (ZDS).[22]

Timing. The primary aim of this report was to explore outcomes at 3 months, 6 months, and 12 months after discharge for patients with acute stroke and MI. However, many studies reported outcomes for more than one time point. Despite a tendency for some studies to measure outcomes in weeks and others in months, it was most common for outcomes to be measured 6 months and 12 months after discharge (Table 11). The most common timing of outcome measures fell between 6 and 11 months after discharge. Using this timeframe, there were 21 articles[15-17,21-24,29,31-33,35,36,40,43,45,48,49,52,53] that reported outcomes for the stroke cohort and 10 studies that reported outcomes for the MI cohort.[57,64-66,68,71-73] Three studies (four articles)[4,5,23,50] measured outcomes at 1 month or 1.5 months after discharge.[15,16,53,71] In each case, outcome measurements were repeated at later time intervals—either at 3 and 6 months after discharge[53,71] or at 6 and 12 months after discharge.[15,16,71] Approximately half of the studies evaluated outcomes only one time—6 studies[34,39,46,61,77,78] at 3 months after discharge, 19 studies[21-24,29,31,33,35,36,40,43,45,48,49,51,52,66,68,73] at 6 months after discharge, and 11 studies[18-20,26,37,47,54-56,58] evaluated outcomes at 12 months after discharge.

Table 11. Summary of Study Time Points Associated With Outcomes[a]

Population	Less than 3 months	3 to 5 months	6 to 11 months	12 months	Over 12 months[b]
AIS only	1 study[53]	3 studies[17,46,53]	8 studies[17,21,29,31,33,40,52,53]	4 studies[18-20,47]	0 studies
MI only	9 studies[57,59,60,63,64,71,72,75,76]	4 studies[61,63,71,78]	8 studies[57,64,66,68,71-73,76]	5 studies[58,62,63,69,71]	1 study[69]
Mixed stroke	3 studies[15,16,27]	3 studies[27,34,39]	13 studies[15,16,22-24,32,35,36,43,45,48,49,51]	8 studies[15,16,26,32,37,54-56]	0 studies
Mixed MI	1 study[59]	3 studies[59,65,77]	2 studies[65,68]	0 studies	0 studies

[a]Studies may be listed multiple times if outcomes were measured at different time points.
[b]Studies reporting outcomes beyond 12 months were included only if they also reported outcomes before 1 year after discharge.
Abbreviations: AIS = acute ischemic stroke, MI = myocardial infarction

Key Question 3

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?

Key Points

- Six studies reported risks, adverse events, or harms, and of those that did, none involved interventions for MI patients.
- 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.
- Reported rates of adverse events were similar for intervention and usual-care groups.
- The available data must be interpreted with caution because data on risks, adverse events, and harms have not been systematically collected or reported across studies.

Detailed Analysis

The definition of risks, adverse events, or harms for a transition of care intervention was any event that caused a failure to improve (i.e., complications such as death, rehospitalization, prolonged length of stay, lost to followup) or that increased burden or anxiety of the patient or caregiver. While some of these events may also be viewed as an outcome of interest for KQ 2, they also represent an adverse event for KQ 3 and thus are included in both sections.

Literature identified. Only 8 articles (2 good quality, 5 fair, 1 poor)[15,26,27,39,40,44,45] representing 6 studies reported data relevant to KQ 3 (Table 12), and all were studies of stroke patients transitioning from hospital to home. With one exception,[44] all were randomized controlled trials with four single-site and three multisite studies. Sample size ranged from 83 to 535 patients, and the comparator in every case was usual care. The interventions included a diverse collection of providers and strategies.

Table 12. Measurement of Risks, Adverse Events, and Potential Harms by Study

Study	Timing of followup	Failure to improve	Burden or anxiety
Allen et al., 2002[39] Allen et al., 2009[40]	3 and 6 months	Severe complications (death, rehospitalization or nursing home admission); composite measure of length of stay (at facility) and death	
Askim, et al., 2004[15]	6 weeks, 6 and 12 months		Caregiver Strain Index
Ayana, et al., 2001[44]	6 months		Patient's opinion of intervention
Boter et al., 2004[45]	6 months		Caregiver Strain Index, Sense of Competence Questionnaire (caregiver), Social Support List–Discrepancies (caregiver)

Study	Timing of followup	Failure to improve	Burden or anxiety
Mayo et al., 2000[27]	1 and 3 months	Impact of losses to followup on functional performance	
von Koch et al., 2000[25] von Koch et al., 2001[26]	6 and 12 months	Death or dependency	

Rather than being provider-focused, all interventions were patient-centered, increasing the potential risk for patient or caregiver burden or anxiety. While only Boter et al.[45] reported descriptive data on the presence of a support system, two studies[15,45] reported caregiver burden as measured by the Caregiver Strain Index. Neither found a difference between the intervention and control groups. Caregivers in the Boter et al. study[45] were also assessed with the Sense of Competence Questionnaire as well as on the discrepancies in social support with the Social Support List-Discrepancies measure, but no differences were found between groups at 6 months. von Koch 2000, 2001 reported living arrangements after discharge (alone or with others), but no measures of burden are reported. Ayana et al.[44] tested the use of a patient-held record and reported that the patients felt the intervention was burdensome. Almost half of the stroke patients discharged with a patient-held record reported that they never received one, 15 percent lost the record before the 6-month assessment, and 23 percent never read or referred to it during the 6-month intervention period. The majority of patients had difficulty engaging providers to add information to the record, and only 15 percent felt the record kept them informed about the treatment over time. There was insufficient evidence to a make a conclusion on patient or caregiver burden related to transition of care interventions for stroke patients.

The impact of the intervention on insurance coverage that was selected as a focus for this review was not reported for any study; however, it may not have been an appropriate focal point for the majority of studies because in this subsample, five of six studies were conducted internationally in countries with national health insurance models. Only the study by Allen et al.[39,40] was conducted in the U.S. and did not report the insurance status of stroke patients. This study did, on the other hand, report a composite outcome of severe complications at 3 months[39] and institutional time and death at 6 months.[40] Both were measures summarizing death, rehospitalization, and nursing home admission, with the latter reporting the number of days and the former reporting a dichotomous outcome (yes/no). Although the intervention was found to produce a positive effect on severe complications at 3 months (moderate effect size of 0.43, 90% confidence interval 0.09 to 0.78), the 6-month outcome was not significantly different between groups. Von Koch et al.[25,26] examined a similar negative outcome of death or dependency on the Barthel Index and had similar findings concluding no difference. There was no significant difference between groups at 6 or 12 months. These two interventions and the structure of the outcome are too dissimilar to draw any conclusions from these findings.

Finally, only Mayo et al.[27] examined those patients lost to followup for whether poor performance influenced attrition. Although it was concluded that the intervention-group patients who did not complete the final evaluation could not have been predicted, persons lost to followup from the usual-care group had significantly lower performance for mobility and activities of daily living. Other studies did not report specific analyses of those lost to followup.

Key Question 4

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?

Key Points

- From a system resource perspective, the evidence for transition of care services for patients with stroke or MI was insufficient because of study designs, sample sizes, and non-U.S. populations.
- Resource use was complex; however, the use of services, particularly emergency department services, is lessened by early education regarding stroke or MI symptoms.
- The greatest impact for education efforts appeared to be early and attenuated over time (during the first 3 months).

MI-specific key points

- Disease management programs may be more effective than remote phone calls only.
- Early return to work after an MI was safe and may be cost-effective from a societal perspective. Returning to work did not increase health care utilization, and it saved the cost of cardiac rehabilitation in patients without complications or comorbidity.

Stroke-specific key points

- Early supported discharge, particularly in patients without complications or comorbidity, was either cost-neutral or cost-effective as it substantially reduced overall hospital days. This difference in hospital days was driven by the early discharge strategy, with no difference observed in rehospitalization rates in either arm. Early supported discharge did not increase burden on family providers, and it reduced days in the hospital and outpatient physical therapy and occupational therapy visits.
- Rehabilitation in a day hospital or at home resulted in similar overall system resource use.
- Integrated-care pathways may facilitate communication transfer to other providers.
- Physician appointments or home visits by physical therapists may reduce readmission rate for stroke patients, particularly those with prolonged rehabilitation and stroke-related impairment prior to the intervention. Visits by nurses did not produce a similar effect.
- Family support and case management services reduced visits to physical therapists and specialists, the cause of which was unknown.

Detailed Analysis

In addition to improving outcomes, transition of care services can facilitate coordination and continuity of care, thereby improving quality and efficiency at a system level. For KQ 4, we addressed the data pertaining to the impact of transition of care services on systems of care for patients with stroke or MI. This question explored resource use and cost implications as well as coordination and use of important services. Less than half of the 44 studies (N = 18) identified in this report addressed the effect of transition of care services on systems of care. Also, the majority of these studies looked at rehospitalization and costs of care, rather than at communication or followup appointments. The MI population data focused on cardiac rehabilitation, postdischarge support and education, and specialist care. The stroke population focused on the transition from hospitalization to home, in terms of early discharge as well as supporting services. Little was found in regard to patient referrals, timely appointments, provider communication, coordination of care, use of urgent care, and emergency department visits. Many of the studies were single center, with non-U.S. populations of fewer than 200 patients. Most studies had few event rates and small population sizes, which limited their ability to provide meaningful comparisons or conclusions.

Literature identified—MI studies. The eight MI studies[59,60,62,69,71,72,75,77] all lacked sufficient numbers of patients or events to determine the impact on resource use as a result of transition of care services (Table 13). Most observations did not show statistical significance because of sample size and low occurrence of the outcomes. All studies except Ho et al.[59] were outside the U.S., which limits the generalizability of practices to U.S. health care.

Table 13. Resource Use and Transition of Care for Patients With MI

System improvements	Studies	Observations
Rehospitalization	Hanssen et al., 2009[69] Kotowycz et al., 2010[60] Robertson et al., 2001[75] Sinclair et al., 2005[77]	Home or phone followup interventions after discharge showed lower rehospitalization, but none are statistically significant (small samples).
	Young et al., 2003[62]	Disease management program demonstrated reduced rehospitalization days out of 1000 patient followup days (p < 0.0001), both overall and cardiac.
Health care utilization[a]	Young et al., 2003[62]	Disease management program demonstrated lower costs of care for emergency room visits, tests, laboratory services.
	Hall et al., 2002[71]	Early return to work did not increase in health care utilization.
Costs	Hall et al., 2002[71]	Early return to work was cost effective by saving on initial cardiac rehabilitation cost in low-risk patients.
MD outpatient visits	Ho et al., 2007[59]	Specialist care resulted in better use of evidence-based medicine and more followup appointments with primary care physicians.
	Kovoor et al., 2006[72]	Early return to work showed no differences in followup appointments with specialist or primary care physicians.

[a]Health care utilization includes emergency department visits, rehospitalization, laboratory and diagnostic testing, and revascularization.
Abbreviation: MI = myocardial infarction

Of the eight MI studies, five[60,62,69,75,77] examined postdischarge support programs, two[71,72] looked at timing for return to work, and one[59] looked at specialty versus primary care in Veterans Affairs (VA) systems. The five studies looking at postdischarge support described phone or nurse visits for 6 to 12 weeks after discharge from an MI.[60,62,69,75,77] These studies were following patients for quality of life, satisfaction, and emotional health as well as adverse events and resource use. The reported rehospitalization rates were not significantly different because of the rare occurrence of rehospitalization. Only the study by Young et al.,[62] which utilized a disease management program with four components after an MI discharge, demonstrated lower use of emergency department visits, diagnostic and therapeutic tests, and hospitalization days in the disease management group compared to the control group.

Two studies looked at the impact of returning to work and specialty care on physician visits after discharge. The study by Ho et al.[59] noted that when both inpatient and outpatient services to acute MI patients were provided by cardiologists (specialists), there was an increased likelihood of visits with primary care physicians in 90 days after discharge. The study by Kovoor et al.[72] determined that early return to work after MI—defined as 2 weeks as opposed to 6 to 8 weeks—had no effect on the resulting use of primary care or specialist clinic visits. In addition, there were no additional increases in health care utilization of laboratory tests or imaging.[71] This also established the safety of early return to work for patients with uncomplicated MI, yielding overall economic benefits due to saving on cardiac rehabilitation costs and returning to productive work.

Literature identified—stroke studies. The 10 stroke studies[17,20,24,26,29,32,36,42,47,51] that examined resource utilization were similarly small in size, often single center, and all were non-U.S. (Table 14). This limits their statistical power and relevance to U.S. practice regarding the impact of transition of care services on cost and care coordination. However, readmission is common in stroke patients, occurring in up to one-third of all patients, and is likely due to stroke-related complications. Accordingly, data in the stroke population are better in terms of rehospitalizations as compared with the MI population. Of the 10 stroke studies, five[17,20,24,26,47] studied early supported discharge, four[32,36,42,51] studied transition of care services following standard discharge, and one studied an integrated-care pathway.[30]

Table 14. Resource Use and Transition of Care for Patients With Stroke

System Improvements	Studies	Observations
Rehospitalization; total hospital days	Andersen et al., 2000[42]	MD or PT home visits after discharge from inpatient rehabilitation significantly reduced readmissions at 6 months (26% or 34% versus 44% control; p = 0.028).
	Bautz-Holtert et al., 2002[17]	Early supported discharge to multidisciplinary team resulted in fewer hospital days than standard care (22 days versus 31 days, p = 0.09).
	Donnelly et al., 2004[47]	Early supported discharge to multidisciplinary community team care resulted in a nonsignificant reduction in overall hospital days and significantly less use of day hospitals.
	Fjaertoft et al., 2005[20]	Early supported discharge resulted in fewer hospital days (66.7 versus 85, p = 0.012).
	Holmqvist et al., 2000[24] von Koch et al., 2001[26]	Early supported discharge resulted in fewer overall hospital days, mostly due to the shortened initial hospitalization (15 versus 30, p < 0.0001).
	Sulch et al., 2000[29]	No difference in overall length of stay of integrated-care pathway versus standard care.
Health care utilization[a]	Mayo et al., 2008[51]	Case management did not alter health care utilization.
	Sulch et al., 2002[30]	Integrated pathway did not alter health care utilization.
	Torp et al., 2006[32]	Supported discharge did not alter health care utilization.
Costs	Donnelly et al., 2004[47]	Early discharge with community team supports trend to cost savings but is not significant.
	Fjaertoft et al., 2005[20]	Early supported discharge was cost-neutral.
	Torp et al., 2006[32]	Supported discharge was cost-neutral compared to usual care.
Outpatient visits/ communications	Fjaertoft et al., 2005[20]	Early supported discharge had increase in clinic visits (11.4 versus 8.9, p = 0.027).
	Holmqvist et al., 2000[24] von Koch et al., 2001[26]	Early supported discharge resulted in fewer day hospital and outpatient PT/OT visits compared to the usual care arm.
	Mant et al., 2000[36]	Family support services resulted in fewer visits to PT compared to control. (44% versus 56%, p = 0.04).
	Mayo et al., 2008[51]	Case management group has fewer visits to specialists after discharge (2.2 versus 3.4, p = 0.01).
	Sulch et al., 2002[30]	Integrated-care pathways improved communications with primary MDs (80% versus 45%, p > 0.0001).
	Torp et al., 2006[32]	Supported discharge did not alter visits to primary care or specialists.

[a]Health care utilization includes emergency department visits, rehospitalization, laboratory and diagnostic testing, and revascularization.
Abbreviations: OT = occupational therapy/therapist, PT = physical therapy/therapist

The studies of early supported discharge varied in process; however, reductions in initial hospitalization seemed feasible and potentially cost-saving. Bautz-Holtert et al.[17] found that combining a multidisciplinary team with early discharge to home resulted in fewer overall hospital days (including baseline hospitalization) without adverse events; however, this was on a selected group of high-functioning stroke patients. Donnelly et al.[47] also noted, on a smaller sample of stroke patients, a trend to fewer hospital days and lower costs with the strategy of early discharge and community multidisciplinary support teams. Similar findings among 320 patients were noted in another study[20] of early supported discharge, with fewer overall hospital days ($p = 0.012$) and no difference in overall costs. In this study, a slight increase in clinic visits in the early discharge group (11.4 versus 8.9, $p = 0.027$) was counterbalanced by fewer overall inpatient rehabilitation days (11.1 versus 23.4, $p = 0.0001$). A study by Holmqvist et al.[24] showed that early discharge resulted in fewer hospital days overall (15 versus 30, $p < 0.0001$), mostly due to the shortened initial hospitalization. The early discharge to home rehabilitation group had no significant differences in other services such as transportation, home health, or assistance from family caregivers. The costs were neutral.[24] Those studies that looked at providing rehabilitation at home versus in a rehabilitation hospital following standard discharge found no significant resource differences. Further differences were an increase in day hospital attendance ($p < 0.001$) and outpatient visits to occupational therapy and physical therapy.[26]

In the four studies[32,36,42,51] of transition of care services following standard discharge, Torp et al.[32] studied discharge supported by an interdisciplinary stroke team versus standard aftercare and found no differences in resource use, GP visits, or health care services. Mant et al.[36] found that family support group patients had a lower use of outpatient PT visits (44 versus 56%, $p = 0.04$), but otherwise there were no differences in use of services. Mayo et al.[51] studied case management involving nursing phone calls and visits to coordinate care 6 weeks after discharge and found no differences in health care utilization between case management patients and controls. There was, however, a slight increase in specialist visits in the usual care group (3.4 versus 2.2, $p < 0.01$). Andersen et al.[42] found that physician or physiotherapist visits to patients with stroke following discharge from an inpatient rehabilitation facility significantly reduced readmissions over and above contact with nursing services only (control) (26% and 33% versus 44%, $p < 0.028$). Therefore, from a cost and resource use perspective, it appears that support is most useful when used in combination with a shortening of the initial hospitalization in selected patients and when delivered in person by skilled staff.

Two studies by Sulch et al.[29,30] studied the role of integrated-care pathways. Integrated-care pathways did not shorten length of stay.[29] In addition, integrated pathways were tested for their ability to improve communications with the outpatient setting. The integrated pathway tested by Sulch et al.[30] did increase notification of primary physicians related to discharge and documentation of information, but there were no significant differences in the process of care between the integrated-care pathway group and the control group.

Key Question 5

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?

Key Points

- Thirteen studies of transition of care explored the benefits and harms as they varied by characteristics.
- The most commonly reported characteristics in transition of care studies were severity, age, sex and presence/absence of depressive symptoms.
- There was a lack of consistency by which characteristics are measured or reported.

Detailed Analysis

Literature identified. We identified 14 peer-reviewed articles (2 good quality, 10 fair, 2 poor) between 2000 and 2010 that were specifically relevant to KQ 5. These 14 articles presented data from 13 studies that enrolled 3420 patients.

Population. The population of interest is the set of patients with vascular disease resulting in AIS or MI who received transition of care services for which there was a difference in benefit or harm that can be related to patient characteristics (Table 15). Study populations were categorized into the followed four cohorts: (1) AIS only, (2) MI only, (3) mixed stroke, and (4) mixed MI. To be included in the sample, studies with a mixed population must also have included patients with ICH stroke, ischemic stroke, MI, or unstable angina with evidence of ischemia.

Table 15. Studies of How Benefits and Harms May Vary by Patient or System Characteristics

Study	Population	N	Intervention	Country	Centers
Allen et al., 2009[40]	AIS only	296	Discharge care management	U.S.	Single
Andersen et al., 2000[42]	Mixed stroke	155	Organized aftercare	Denmark	Multi (3)
Askim et al., 2006[16]	Mixed stroke	62	Early supported discharge	Norway	Single
Barlow et al., 2009[78]	MI only	192	Expert Patient Programme	U.K.	Single
Ertel et al., 2007[48]	Mixed stroke	291	Home care cognitive behavioral therapy	U.S.	Multi (4)
Fjaertoft et al., 2005[20]	AIS only	320	Extended stroke unit services	Norway	Single
Gallagher et al., 2003[67]	Mixed MI	196	Education and followup	Australia	Single
Geddes et al., 2001[50]	Mixed stroke	1076	Coordinated care	U.K.	Multi (6)
Indredavik et al., 2000[21]	AIS only	320	Extended stroke unit services	Norway	Single
Lusczynska et al., 2006[73]	MI only	114	Followup with implementation intervention program	Poland	Single
Mant et al., 2000[36]	Mixed stroke	323	Family support	U.K.	Not clear

Study	Population	N	Intervention	Country	Centers
Teng et al., 2003[28]	Mixed stroke	114	Early supported discharge	Canada	Single
Torp et al., 2006[32]	Mixed stroke	198	Early supported discharge	Denmark	Single
von Koch et al., 2001[26]	Mixed stroke	83	Early supported discharge	Sweden	Single

Abbreviations: AIS = acute ischemic stroke, MI = myocardial infarction

From these 14 original articles, three studies[20,21,40] included only patients with AIS (AIS only); two studies[73,78] included only patients with MI (MI only); seven studies[16,28,32,36,42,48,50] had a mixed-stroke population that included patients with stroke, and either did not define stroke as ischemic/hemorrhagic or included AIS and other stroke (ICH and/or SAH); and one study[67] included a mixed-MI population defined as acute coronary syndrome or patients with MI as well as other patients (but not stroke). There were no studies that included only patients with combined stroke and MI, and no studies that explored transition interventions for patients diagnosed only with ICH.

The 14 articles described single-center and multicenter studies around the world. Single-center studies were performed in the U.S.,[40] Norway,[16,20,21] U.K.,[78] Australia,[67] Poland,[73] Canada,[28] Denmark,[32] and Sweden.[26] Multicenter studies were conducted in Denmark,[42] U.S.,[48] and U.K.[50]

Subgroups. There was a lack of consistency with regard to which characteristics were explored for their relationship to benefits and harms of transition of care interventions. Table 16 provides details about the most frequently reported subgroup characteristics in transition intervention studies.

Table 16. Subgroup Characteristics

Study[a]	Severity	Age	Sex	Depression	Knowledge/education	Race/ethnicity	Comorbidity	Premorbid status	Health care provider	MMSE	Rehospitalization	Prior stroke/MI	Length of stay	Social ties	Duration since discharge	Frailty/stress[b]	Geography	Work status
Allen et al., 2009[40]	X	X	X	X		X	X	X				X						
Andersen et al., 2000[42]		X	X	X	X				X				X					
Askim et al., 2006[16]	X																	
Barlow et al., 2009[78]		X	X				X								X			
Ertel et al., 2007[48]	X	X	X	X	X					X				X		X		
Fjaertoft et al., 2005[20]	X																	
Gallagher et al., 2003[67]		X	X							X	X							X
Geddes et al., 2001[50]	X	X			X				X									
Indredavik et al., 2000[21]	X																	

Study[a]	Severity	Age	Sex	Depression	Knowledge/education	Race/ethnicity	Comorbidity	Premorbid status	Health care provider	MMSE	Rehospitalization	Prior stroke/MI	Length of stay	Social ties	Duration since discharge	Frailty/stress[b]	Geography	Work status
Lusczynska et al., 2006[73]								X										
Mant et al., 2000[36]																	X	
Teng et al., 2003[28]	X																	
Torp et al., 2006[32]	X																	
von Koch et al., 2001[26]				X														

[a]Articles cited in the Study Characteristics (Table 5) that are secondary or followup data analyses of an earlier study are not included in this table.
[b]Frailty/stress is any measure of the patient's condition of frailty or experiencing a stressful event.
Abbreviations: MMSE = Mini-Mental State Examination

The relationship between outcomes and severity of illness was the most frequently reported characteristic.[16,20,21,28,32,40,48,50] The measures of severity that were reported included National Institutes of Health Stroke Scale (NIHSS), Scandinavian Stroke Scale (SSS), Barthel Index, and modified Rankin Scale (mRS). Other common subgroup analyses were performed for age,[40,42,48,50,67,78] and sex,[40,42,48,67,78] while only one study[40] explored the relationship of race/ethnicity to outcomes. Depression was an outcome of interest in 18 articles,[31,33-37,40,45-47,51,52,54,55,63-65,78] but depression was also explored as a characteristic in four studies.[26,40,42,48] Three studies[42,48,50] explored some form of patient baseline knowledge/education. The patient's premorbid status or number of comorbidities was explored in four studies.[40,48,73,78] Only two studies[42,50] explored system-level characteristics by describing the relationship of health care provider to patient outcomes.

Benefits and Harms. Each of the studies reported at least one significant finding attributed to one or more patient-based or system-based characteristic (Table 17). Functional status at discharge, while measured using different tools, was found to be a significant predictor of outcome in 8 studies.[15,16,18-21,25,26,28,32,48,50] The outcome for these 8 studies varied from balance to depression and morbidity; there was no universal outcome associated with functional status. The most common characteristics analyzed were age and sex, which were reported in all but two studies.[73,77] Only two studies[36,37,50] reported systems-based characteristics with significant findings. Geddes et al.[50] found that patients who were deceased or transferred to a nursing home 1 year after home-based rehabilitation were more likely to have been referred by a general practitioner compared to having been referred by hospital-based personnel. In a study of MI patients, Mant[36,37] found that admission to a specialty rehabilitation after discharge was associated with improved functional status at 6 months.

Table 17. Studies Showing Significant Findings for Transition Intervention

Study	Characteristic	Significant finding
Allen et al., 2009[40]	History of prior stroke, TIA, atrial fibrillation	Greater benefit from care management of neuromotor function
Andersen et al., 2000[42]	Longer length of stay (usual care group), Unskilled status, older age, history of depression	Higher readmission for usual care group Increased risk of readmission
Askim et al., 2006[16]	Severe or moderate paresis	Worse balance after 1 year
Barlow et al., 2009[78]	Females[a]	Reduced depression and anxiety in intervention group
Ertel et al., 2007[48]	Males[a] Not frail[a] Less severe stroke[a] High MMSE Lower depression scores[a] High depression score[a] Fewer comorbidities	Higher cognitive score Higher ADL and lower mortality Higher cognition scores Trend to higher ADL (p = 0.08) Trend to lower mortality (p = 0.07) Trend to higher mortality (p = 0.08) Higher instrumental ADL scores
Fjaertoft et al., 2005[20]	High function[a]	Higher cost
Gallagher et al., 2003[67]	Younger females (compared to age 55 to 70) Rehospitalized, not working, experiencing a stressful event, poor perception of control History of depression	Worse adjustment to illness scores Higher anxiety and depression Higher depression
Geddes et al., 2001[50]	GP referral (compared to hospital personnel referral), older age, poor cognitive function, more severe stroke	Deceased or transferred to nursing home after rehabilitation
Indredavik et al., 2000[21]	Moderate to severe stroke[a]	More improvement in mRS and Barthel Index scores
Lusczynska et al., 2006[73]	Physical activity before MI	Physical activity after MI
Mant et al., 2000[36]	Admission to specialty rehabilitation[a]	Higher SF-36 scores
Teng et al., 2003[28]	Functional status at discharge	No difference in cost
Torp et al., 2006[32]	Functional status at discharge	No difference in length of stay or rehospitalization
von Koch et al., 2001[26]	Higher coping capacity	Greater independence

[a]Difference was seen or analyzed in the intervention group.

Abbreviations: ADL = activities of daily living, GP = general practitioner, MI = myocardial infarction, MMSE = Mini-Mental State Examination, mRS = modified Rankin Scale, SF-36 = Short Form-36, TIA = transient ischemic attack

Secondary analysis for KQ 5. After exploring the data from the 14 transition articles identified above that analyzed differences in outcome for various characteristics within a single study, we sought to explore for patterns of benefit or harm between the transition studies. To accomplish this, we examined the relationships of key characteristics between studies that reported benefit or harm associated with a transition of care intervention.

From the 62 articles included in this systematic review, there were 22 articles[16,18-21,24,33-35,40,46,52,54-56,59,61,64-66,73,77] that identified some benefit to a transition intervention. To fully explore for patterns in characteristics associated with patients who benefited from the intervention, the four main subgroup characteristics identified in Table 16 (severity of stroke/MI, age, sex, and depression) were abstracted for each outcome measure that reported a benefit of a transition intervention (Table 18). Across the studies that reported benefit, the mean age was between 56 and 82 years. The percentage of male patients in the stroke studies that reported benefit was 42 to 61 percent.[16,18-21,24,33-35,40,46,52,54-56]

Of studies that found a benefit to the intervention and reported sex in the MI population, one study conducted in a VA population[59] reported that 97 percent of subjects were male; in the remaining MI population studies, the percentage of male subjects ranged from 46 to 70 percent.[61,64-66] Severity of illness/injury was reported in 11 studies.[16,18,21,24,35,40,52,55,56,59,66] Studies that reported baseline mRS values and found benefit from the transition intervention generally reported baseline mRS of greater than 2 as a characteristic,[16,21,55,56] whereas Fjaertoft et al.[18] reported that 6.3 percent of patients who benefited from ESUS had mRS less than 3. Studies that included NIHSS scores found benefit from the transition intervention when the mean NIHSS was less than 5.[35,40,52] Baseline depression was explored using CES-D,[40] EQ-5D,[64] GDS,[46,52] and HADS.[35,64,65] With the exception that depression scores at baseline predicted later depression scores,[46,64,65] there was no consistent relationship between depression and a transition intervention.

Characteristics from studies that found a benefit to the intervention. There were 17 studies (22 articles)[16,18-21,24,33-35,40,46,52,54-56,59,61,64-66,73,77] that reported a positive effect from the transition intervention and included data for patient characteristics. The four most frequently reported subgroup characteristics were severity of stroke/MI, age, sex, and depression. As noted in Table 18, there was insufficient evidence to support the hypothesis that response to any given transition of care intervention varies by patient characteristics. There was only a modest variation in age and sex reported. The mean age reported varied from a low of 56 in one MI study[61] of 65 patients to a high of 82 in a stroke study.[52] Given the exception of a study performed in a VA population where the sample was 97 percent male,[59] the percentage of male patients ranged from 42 percent in a study of 138 stroke patients[34] to 70 percent in a study of 65 patients with MI.[61]

Table 18. Studies That Found a Benefit of Transition Intervention

Study[a]	Population[b]	N	Outcomes improved by intervention[c]	Mean age[d]	% male[e]	Severity	Depression
Allen et al., 2009[40]	AIS only	296	Knowledge	68	50	NIHSS = 2	CES-D = 2.8
Askim et al., 2006[16]	Mixed stroke (study population[15])	62	BBS Timed walk	77	52	SSS = 45.4 Barthel Index = 57.7 mRS = 3.7	NR
Bambauer et al., 2005[65]	Mixed MI	100	HADS SRH	61	65	NR	HADS = 8.5
Claiborne et al., 2006[46]	AIS only	28	Compliance (self-care) GDS SF-36 MCS	70	44	NR	GDS = 10.8
Clark et al., 2003[33]	AIS only and Caregiver	62	AAP Barthel Index FAD	73	59	NR	NR
Costa e Silva et al., 2008[66]	MI only	153	Compliance (diet) Compliance (followup)	59	48	STEMI = 83.3%	NR
Fjaertoft et al., 2003[18]	AIS only (study population[21])	320	mRS	74	54	mRS < 3 = 6.3% Barthel Index > 94 = 52.5%	NR
Fjaertoft et al., 2004[19]	AIS only (study population[21])	320	NHP	74	54	NR	NR
Fjaertoft et al., 2005[20]	AIS only (study population[21])	320	Length of stay	74	54	NR	NR
Ho et al., 2007[59]	Mixed MI	4933	Death	66	97	TIMI risk = 3.2	NR
Hoffmann et al., 2007[34]	Mixed stroke	138	Patient satisfaction	67	42	NR	NR
Holmqvist et al., 2000[24]	Mixed stroke and Caregiver	81	Patient satisfaction	68	55	CT scan, coping, comorbidity	NR
Indredavik et al., 2000[21]	AIS only	320	Length of stay mRS	74	54	Barthel Index = 60.4 mRS = 3.3 SSS = 43.6	NR
Johnston et al., 2007[35]	Mixed stroke and Caregiver	203	OAD	69	61	Barthel Index = 18.0 NIHSS = 4.6	HADS = 6.9
Joubert et al., 2006[54]	Mixed stroke	97	PPT	65	51	NR	NR
Joubert et al., 2008[55]	Mixed stroke	233	PHQ-9	63	58	mRS > 2 = 26%	NR
Joubert et al., 2009[56]	Mixed stroke (study population[55])	186	mRS Quality of life	63	58	mRS > 2 = 26%	NR
Lacey et al., 2004[64]	MI only	152	EQ-5D HADS	67	67	NR	HADS = 5.3 EQ-5D = 0.5
Lusczynska et al., 2006[73]	MI only	114	PPT	NR	NR	NR	NR

Study[a]	Population[b]	N	Outcomes improved by intervention[c]	Mean age[d]	% male[e]	Severity	Depression
Petrie et al., 2002[61]	MI only	65	ACS IPQ Patient satisfaction Work	56	70	NR	NR
Ricauda et al., 2004[52]	AIS only	120	GDS	82	45	CNS = 6 FIM = 41.5 NIHSS = 24	GDS = 17.5
Sinclair et al., 2005[77]	Mixed MI	324	Rehospitalization	NR	NR	NR	NR

[a]The Grasel et al.,[22] Hanssen et al.[68] and Mayo et al.[27] studies are excluded from this table because they did not have any measures with positive impact across all time points. The Mant et al.[36] study had no patient outcomes.
[b]Caregiver measures are not included in this table.
[c]Measures that reported improvement at first time point but not at a later assessment were not included (e.g., SF-36 improved at 6 months but was unchanged at 12 months).
[d]Mean age is the mean age of intervention group (mean age of entire sample if not given for each group).
[e]% male is the percentage of males in the intervention group (percent male of entire sample if not given for each group).
Abbreviations: AAP = Adelaide Activities Profile, ACS = acute coronary symptoms, AIS = acute ischemic stroke, BBS = Berg Balance Scale, CES-D = Center for Epidemiological Studies-Depression, EQ-5D = EuroQol 5 Dimensions, FAD = McMaster Family Assessment Device, GDS = Geriatric Depression Scale, HADS = Hospital Anxiety and Depression Scale, IPQ = illness Perception Questionnaire, MI = myocardial infarction, mRS = modified Rankin Scale, NHP = Nine-Hole Peg Test, NIHSS = National Institutes of Health Stroke Scale, OAD = Observer-Assessed Disability, PPT = physical performance test, SF-36 = Short Form-36, SF-36 MCS = Short Form-36 Mental Component Summary, SRH = Self-Rated Health, TIMI = thrombolysis in myocardial infarction

There was a lack of consistency in the use of instruments for reporting illness severity. There were only 11 studies that reported severity of illness at the time of admission in the subset of studies that found a benefit to the intervention and reported characteristics associated with outcomes. Studies including patients with stroke reported severity using NIHSS,[35,40,52] SSS,[16] Barthel Index,[16,18,21,35] CNS,[52] FIM,[52] and mRS;[16,18,21,55,56] and one study[24] reported CT scan results along with coping and comorbidities. For the studies including cardiac patients, only two reports[59,66] included illness severity scales. Ho et al.[59] found a mean thrombolysis in myocardial infarction (TIMI) risk score of 2.2 in their study of 4922 cardiac patients, wherein the finding of lower mortality was associated with a hospital-based preparation model of transition intervention. A smaller study[66] of 153 MI patients reported that STEMI versus non-STEMI as a measure of severity in a community-based support intervention was associated with improved compliance with dietary recommendations and improved rates of physician followup.

The presence and rating of depression was reported in four stroke studies[35,40,46,52] and two MI studies.[64,65] Six studies reported findings using four different depression rating scales: HADS,[35,64,65] GDS,[46,52] EQ-5D,[64] and CES-D.[40] Notably, four[46,52,64,65] of the six studies that reported depression scores as a characteristic also reported that the transition intervention improved depression; hence, these studies suggest that while the transition intervention improved depression, the effect of the transition was moderated by the presence/absence of baseline depression.

Characteristics of studies for which the intervention was associated with a negative outcome. Only 2 articles[31,34] of the 62 articles reported any form of harm for subjects who received a transition intervention. Sulch et al.[31] used an integrated-care pathway for 76 patients in the intervention group and compared results to 76 patients who received usual care (no integrated-care pathway). Groups were similar at baseline, but depression scores at 3 months were worse for those who received the intervention compared to those who did not; mRS at discharge was independently associated with depression. Hoffman et al.[34] provided 69 patients with a computer-generated educational intervention that was tailored to their needs. The intervention group, when compared to the 69 subjects who received usual education, was reported to have higher levels of anxiety. In this study, the intervention group had a significantly higher male-to-female ratio than did the control group; there was no report of independent association of anxiety scores and sex.

Summary and Discussion

For this report, 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. For some patients, that process involved a transient stay in an acute rehabilitation setting followed by discharge to home, while for others the transition involved relocation to a skilled nursing home or assisted living environment. 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]

The conceptual model we worked with was one that began with hospital-based preparation for discharge to home or to intermediary care units and subsequently involved community-based resources such as multidisciplinary care teams, group support services, and patient- and family-focused educational programs. The process of hospital-based discharge preparation often included education of the patient and/or their family or health care providers as well as initiating followup care with primary and specialty care providers. Community-based support services were often initiated at this time as well. Educational programs based in the community were also evaluated, as were community-based systems of support. Although the majority of patients with stroke or MI also had a number of concurrent chronic medical conditions such as diabetes, hypertension, and hyperlipidemia that had contributed to the sentinel presenting event (stroke or MI), we did not incorporate chronic disease management models as a component of transition of care.

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 discharge planning process (intervention type 1). This phase included interventions such predetermined integrated-care pathways, early supported discharge, extended stroke unit services, and rehabilitation coordination with community services. Education of the patient and their 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 their family (intervention type 3) could be provided through advanced practice nurse care managers, primary care and specialty-based medical practitioners, and multidisciplinary care teams. 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 limited evidence in favor of some components of hospital-based discharge planning (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 This Review

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. 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 U.S. in countries with significantly different health care systems than ours (frequently in countries with single-payer systems), thus making translation of their results inappropriate.

Conclusions

This systematic review showed limited evidence for making definitive conclusions about the effectiveness of transition of care services following stroke or MI. 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 that 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 U.S. 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, 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 U.S. 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.

Table 19 summarizes the findings for each key question.

Table 19. Summary of Key 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-based preparation 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. 8 studies used a hospital-based preparation 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-based discharge planning (type 1 intervention) 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-based preparation (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.

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.

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 NIH Stroke Scale) demonstrated a benefit from transition of care interventions compared to those with more severe deficits.

Future Research

In this chapter, we propose activities through which identified gaps could be filled by future research studies that investigate issues related to transition of care for patients following stroke and MI. We began our review process by creating a model that described the transition of care as a process that starts during hospitalization at the stage of planning for discharge (intervention type 1); includes education of the patient and their caregivers during hospitalization (intervention type 2a) as well as in the community (intervention type 2b); and is followed up by community support services (intervention type 3) and transitioning to long-term, chronic models of care (intervention type 4).

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. A clearer set of guidelines and terms that would be used to define interventions to be studied is needed for each component of the transition of care process (intervention types 1–4). We found significant heterogeneity in the definition of discharge planning among studies. Even the term “early supported discharge” was used to define a process that varied from center to center in terms of its constituent parts. This form of heterogeneity makes cross-study comparisons difficult and multicenter studies challenging.

We found that transition of care following stroke and MI could be evaluated in the context of four different types of interventions, each with a multitude of components. These components 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 since 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 were 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. For example, using an outcome such as the severity of neurological deficit as measured by the NIH Stroke Scale at 6 months after an acute stroke cannot be considered an appropriate measure of the effectiveness of an educational program focusing on medication compliance. 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 that 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 different strategies aimed at educating the patient and their families regarding their medical condition (intervention type 2), 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 (intervention types 3 and 4). 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 U.S. has not been evaluated.

Two examples of components that are suited for focused study are the role of health-related educational efforts in evaluating medication compliance (intervention type 2) and the optimal implementation of an electronic medical record to facilitate communication among multiple providers (primary care, specialty care, care coordinators, rehabilitation specialists) after an acute hospitalization (intervention type 4).

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 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 U.S., 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 U.S. More studies should be conducted under the health care system for which the intervention is intended to benefit.

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Abbreviations

AAP	Adelaide Activities Profile
ACS	acute coronary syndrome
ADL	activities of daily living
AE	adverse event
AHRQ	Agency for Healthcare Research and Quality
AIS	acute ischemic stroke
AshSS	Ashworth Spastic Scale
BBS	Berg Balance Scale
BSFC	Burden Scale for Family Caregivers
CABG	coronary artery bypass grafting
CDC	Centers for Disease Control and Prevention
CES-D	Center for Epidemiological Studies-Depression
CGI-I	Clinical Global Impressions-Improvement
CI	confidence interval
CII	clinical improvement index
COOP	Dartmouth-Northern New England Primary Care Cooperative Information Project (COOP)
CNS	Canadian Neurological Scale
CSS	cognitive summary score
DHDSP	Division for Heart Disease and Stroke Prevention
EADL	Nottingham Extended Activities of Daily Living
ED	emergency department
EPC	Evidence-based Practice Center
EQ-5D	EuroQOL 5 Dimensions (descriptive system)
ESD	early supported discharge
ESUS	extended stroke unit services
FAD	McMaster Family Assessment Device
FAI	Frenchay Activities Index
FIM	functional impairment measure
FQM	functional quality of movement measure
GAP	guidelines applied in practice
GDS	Geriatric Depression Scale
GHQ	General Health Questionnaire
GP	general practitioner
IADL	Index of Activities of Daily Living
ICH	intracerebral hemorrhage
IPQ	Illness Perception Questionnaire
IRF	inpatient rehabilitation facility
LHS	London Handicap Scale
LMC	Lindmark Motor Capacity
MADRS	Montgomery-Asberg Depression Rating Scale
MeSH	medical subject headings

MI	myocardial infarction
MIDAS	Myocardial Infarction Dimensional Assessment Scale
MMSE	Mini-Mental State Examination
mo	month or months
mRS	modified Rankin Scale
N or n	number (subjects/population)
NA	not applicable
NHP	Nottingham Health Profile
NIH	National Institutes of Health
NIHSS	NIH Stroke Scale
NPT	Nine-Hole Peg Test
NR	not reported
ns or NS	not significant
NSTEMI	non–ST elevation myocardial infarction
OAD	observer-assessed disability
p	probability
PA	psychosocial assessment
PBSI	Preference-Based Stroke Index
PCP	primary care physician
PHQ-9	Patient Health Questionnaire (depression model)
PICOTS	population, intervention, comparator, outcome, timing, setting
RAT	Reinvang aphasia test
RCT	randomized controlled trial
RMI	Rivermead Mobility Index
RNLI	Reintegration to Normal Living Index
RR	risk ratio
SAH	subarachnoid hemorrhage
SASC	Satisfaction With Stroke Care questionnaire
SF-36	Short Form health scale (36 questions)
SF-36 MCS	SF-36 mental component summary scale
SF-36 PCS	SF-36 physical component summary scale
SIP	Sickness Impact Profile
SNA	service needs assessment
SNF	skilled nursing facility
SRH	self-rated health
STEMI	ST elevation myocardial infarction
TEP	Technical Expert Panel
TIA	transient ischemic attack
TUG	Timed Up-and-Go test
ZDS	Zerssen Depression Scale