Hospitals now have the responsibility to implement strategies to prevent adverse outcomes after discharge. This systematic review addressed the effectiveness of hospital-initiated care transition strategies aimed at preventing clinical adverse events (AEs), emergency department (ED) visits, and readmissions after discharge in general medical patients. MEDLINE, CINAHL, EMBASE, and Cochrane Database of Clinical Trials (January 1990 to September 2012) were searched, and 47 controlled studies of fair methodological quality were identified. Forty-six studies reported readmission rates, 26 reported ED visit rates, and 9 reported AE rates. A “bridging” strategy (incorporating both predischarge and postdischarge interventions) with a dedicated transition provider reduced readmission or ED visit rates in 10 studies, but the overall strength of evidence for this strategy was low. Because of scant evidence, no conclusions could be reached on methods to prevent postdischarge AEs. Most studies did not report intervention context, implementation, or cost. The strategies hospitals should implement to improve patient safety at hospital discharge remain unclear.

**The Problem**

Nearly 1 in 5 Medicare patients is readmitted within 30 days of discharge from the hospital (1). This proportion has not changed substantially over the past several years (2) despite intense efforts to improve the discharge process. Patients are vulnerable to a wide range of adverse events (AEs) after discharge, with more than 20% of medical patients sustaining a preventable AE within 3 weeks of discharge (3). Multiple issues contribute to ineffective care transitions, including poor communication between inpatient and outpatient clinicians (4); medication changes during hospitalizations (5); inadequate patient understanding of diagnoses, medications, and follow-up needs (6); discharging patients with incomplete diagnostic work-ups (7); and other, more general patient-related and health care system–related factors (8–10).

Several policy initiatives have recently been implemented to encourage improvements in transitional care. The Centers for Medicare & Medicaid Services publicly reports hospitals’ risk-adjusted 30-day readmission rates for patients hospitalized with pneumonia, acute myocardial infarction, or congestive heart failure (11). The Centers recently announced that more than 2000 hospitals will suffer financial penalties of up to 1% of Medicare reimbursements because of high readmission rates (12). The Partnership for Patients initiative aims to decrease preventable readmissions by 20% by the end of 2013 and has identified improving transitional care as an opportunity to reduce health care expenditures (13). Together, these policies constitute a mandate to hospitals to improve transitional care at hospital discharge.

Little information is available on effective transitional care strategies for general medical inpatients. Prominent national organizations have recommended a range of interventions (14), which are being implemented widely. However, little evidence supports their effect on readmissions or other important markers of postdischarge patient safety, such as emergency department (ED) visits and AEs occurring shortly after discharge. Moreover, a recent review (15) identified no interventions proven to reduce 30-day readmission rates in general patient populations, although it did not focus on hospital-initiated interventions. Because financial penalties place the onus on hospitals to be primarily responsible for implementation of strategies to prevent adverse outcomes after discharge, we conducted a systematic review of the effectiveness of hospital-initiated care transition interventions on reducing AEs, ED visits, and readmissions after discharge in general medical patients.

**Patient Safety Strategies**

We defined a “transitional care strategy” as 1 or a group of interventions initiated before hospital discharge with the aim of ensuring the safe and effective transition of patients from the acute inpatient setting to home. To synthesize a variety of published interventions, we classified specific interventions on the basis of an existing taxonomy of transitional care interventions (16–21). We grouped transitional care strategies into 3 categories according to the timing and setting of intervention components: predischarge, postdischarge, and “bridging” (including both pre- and postdischarge components) (Table 1) (15).

We defined postdischarge AEs as any of the following patient experiences—all representing clinically meaningful...
injuries from medical care — occurring after hospital discharge: new or worsening symptoms, laboratory abnormalities (such as elevated international normalized ratio) necessitating a change in clinical management, and injuries (such as adverse drug events, falls, or hospital-acquired infections) attributable at least in part to hospital care. This definition was based on classifications (3, 22) used in previous studies that analyzed the epidemiology of postdischarge AEs.

**Review Processes**

As part of this supplement on patient safety, our purpose was to evaluate the effect of transitional care strategies initiated in the hospital on adverse outcomes after discharge compared with usual discharge care. We searched MEDLINE, CINAHL, EMBASE, and the Cochrane Database of Controlled Trials from January 1990 through September 2012 using a search strategy developed with the assistance of a medical librarian. We included English-language, randomized, controlled trials (RCTs) and non-randomized, controlled clinical trials that evaluated the effect of a transitional care strategy initiated before hospital discharge on postdischarge AE rates, ED use, or readmission rates after discharge home. To be included, studies must have enrolled an undifferentiated population of adult general medical patients. We excluded studies conducted in disease-specific populations, studies of other formal care programs (such as disease management programs) that were not initiated in the hospital or did not explicitly target care transitions, and studies focusing on transition from hospitalization to another acute or subacute care setting.

We included studies that reported intervention costs only if one of the main outcomes was also reported. Study investigators screened 20,248 titles identified by the search strategy for relevance and reviewed a sample of excluded titles for accuracy. Two investigators independently reviewed the full text of potentially relevant studies (n = 762) to determine study eligibility. Two investigators independently reviewed the 47 studies that met inclusion criteria. They extracted data on the following domains: study design, methodological quality, study setting, participants (type of health system, target population), details of the intervention components, and outcomes. Disagreements on specific fields were resolved by consensus and discussion with a third investigator if necessary. Reviewers rated the quality of individual studies using the Cochrane Collaboration Effective Practice and Organisation of Care checklist; they also rated the overall strength of evidence supporting specific strategies according to the method used for the Agency for Healthcare Research and Quality evidence report for which this project was performed (23). The main outcomes extracted were AE rates and ED and readmission rates within 30 days after hospital discharge. Additional outcomes included readmissions, ED visits, and AE rates up to 1 year after discharge. Given the heterogeneity of interventions, study settings, and patient populations, we chose not to perform a meta-analysis. See the Supplement (available at www.annals.org) for a complete description of the search strategies; the detailed article flow diagram; and evidence tables, including quality ratings.

This review was supported by the Agency for Healthcare Research and Quality, which had no role in the selection or review of the evidence or the decision to submit this manuscript for publication.

**Benefits and Harms**

Of 47 eligible studies, 28 were RCTs (24–51) and 19 were controlled clinical trials (52–70). Most were rated as having fair methodological quality (see Table 3 of the Supplement).

**Benefits**

**Patient Populations, Risk Factors, and Settings**

About half of the studies (n = 24) were conducted within the United States. The majority (n = 27) targeted older adult populations, although definitions of “elderly” varied widely (enrolling patients older than age 55 years in 1 case [25]). Twelve studies targeted individuals at “high risk” for readmissions or AEs, although definitions of “high risk” were inconsistent across studies. Seven studies tar-
**Table 1. Taxonomy of Interventions to Improve Transitional Care at Hospital Discharge**

<table>
<thead>
<tr>
<th>Predischarge interventions</th>
<th>Total Studies, n</th>
<th>Mean EPOC</th>
<th>Statistically Significant Reduction in Readmissions or ED Visits</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of risk for adverse events or readmissions</td>
<td>17</td>
<td>3.53</td>
<td>6</td>
<td>Wide variation in types of interventions and providers involved</td>
</tr>
<tr>
<td>Patient engagement (e.g., patient or caregiver education)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creation of an individualized patient record (customized document in lay language containing clinical and educational information for patients’ use after discharge)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilitation of communication with outpatient providers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multidisciplinary discharge planning team</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dedicated transition provider (who has in-person or telephone contact with patient before and after discharge)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medication reconciliation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Postdischarge interventions**

<table>
<thead>
<tr>
<th>Postdischarge interventions</th>
<th>Total Studies, n</th>
<th>Mean EPOC</th>
<th>Statistically Significant Reduction in Readmissions or ED Visits</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outreach to patients (including follow-up telephone calls, patient-activated hotlines, and home visits)</td>
<td>30</td>
<td>4.83</td>
<td>12</td>
<td>Most transition providers were nurses; postdischarge patient contact was via telephone call or home visit; probably resource-intensive, but little information provided on cost or ease of implementation</td>
</tr>
<tr>
<td>Facilitation of clinical follow-up (including facilitated ambulatory provider follow-up)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medication reconciliation after discharge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Bridging interventions**

<table>
<thead>
<tr>
<th>Bridging interventions</th>
<th>Total Studies, n</th>
<th>Mean EPOC</th>
<th>Statistically Significant Reduction in Readmissions or ED Visits</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inclusion of at least 1 predischarge component and at least 1 postdischarge component</td>
<td>10</td>
<td>4.6</td>
<td>2</td>
<td>Wide variation in types of interventions and providers involved</td>
</tr>
</tbody>
</table>

**Characteristics of Transitional Care Strategies**

Studies used a median of 4 separate interventions (range, 1 to 8) (Table 2 of the Supplement). Thirty studies (21 RCTs) used a bridging strategy with both pre- and postdischarge intervention components, and 17 studies (7 RCTs) included only hospital-based, predischarge interventions. The strategies included a variety of separate interventions. The most commonly used interventions included patient engagement (n = 37), ranging from general patient education to more specific instruction on symptom management and medication counseling. Twenty-eight studies included postdischarge outreach to patients by telephone (n = 10), home visit (n = 8), or both telephone contact and at least 1 home visit (n = 10). Of the 30 studies that included a bridging intervention, 20 included a designated transition provider who had contact with the patient in the hospital and in the outpatient setting after discharge (Table 2).

**Effect of Transitional Care Strategies on Postdischarge AEs**

Nine studies reported AE rates after discharge (29–32, 38, 40, 44, 59, 70) (Table 4 of the Supplement). Of these, 3 reported statistically significant reductions in postdischarge AE rates (31, 44, 70). Gillespie and colleagues (31) found that a pharmacist-led intervention reduced medication-related readmissions within 12 months of hospital discharge. The intervention targeted elderly patients and involved inpatient monitoring, counseling, discharge teaching and medication reconciliation, and postdischarge telephone follow-up. Schnipper and colleagues (44) reported that a similarly comprehensive pharmacist-led intervention reduced preventable drug AEs and reduced a composite outcome of medication-related ED visits and hospital readmissions within 30 days of hospital discharge. Another pharmacist-led study (70) that included discharge medication counseling without postdischarge follow-up reduced adverse drug events in a Saudi Arabian population. Two additional studies (30, 59) reported reductions in postdischarge AEs with pharmacist-led medication safety interventions; findings were not statistically significant, but both studies were underpowered to detect important differences between intervention and control groups.
Effect of Transitional Care Strategies on 30-Day Readmission and ED Visit Rates

Forty-six studies reported readmission rates at intervals ranging from 15 days to 1 year after the index hospital discharge; 22 of these studies (12 RCTs) reported readmission rates or ED visit rates 30 days or less after discharge (Table 5 of the Supplement). Eight studies (4 RCTs) reported statistically significant reductions in 30-day readmission rates, ED visits, or a composite of the 2 outcomes. Six of the 8 studies used a bridging intervention that included a dedicated provider who had primary responsibility for ensuring safe transitions (26, 27, 33, 34, 55, 67). Transition providers met with patients before discharge to provide patient education and conducted posthospital outreach to patients via telephone or home visits. Transition providers also created individualized, patient-centered health records and communicated information about the hospitalization to the patient’s primary care provider. Three studies that evaluated the Care Transitions Intervention (CTI)—an intervention with a “transition coach” who performed postdischarge home visits that emphasized patient education and self-management—reported reductions in 30-day readmissions (26, 55, 67) when conducted in managed care systems, capitated delivery systems, and Medicare fee-for-service populations. Another similar intervention, Project RED, reduced 30-day ED visits at an urban safety net hospital (33). A nurse discharge advocate was responsible for patient education and communication of clinical information to the patient’s primary care provider, and a clinical pharmacist reviewed the discharge plan and medication management by telephone with the patient after discharge.

Fourteen studies (8 RCTs) reported no statistically significant reductions in 30-day readmission or ED visit rates. These studies were broadly similar to the successful studies in terms of sample size and methodologic quality. Four used a bridging intervention with a dedicated transition provider. One, which evaluated the CTI in a Medicare fee-for-service population, reported a reduction in readmissions at 90 days after discharge (43).

ED Visits and Readmission Rates Beyond 30 Days After Discharge

Twenty-six studies reported ED visit rates, readmission rates, or a composite of the 2 outcomes at intervals ranging from 45 days to 1 year after the index discharge. Seven studies reported statistically significant reductions in readmission rates, including 4 studies (39, 40, 43, 47) that used a bridging intervention with a dedicated transition provider.

Harms

None of the studies reported any harms associated with transitional care interventions.

IMPLEMENTATION CONSIDERATIONS AND COSTS

Although a majority of studies \( (n = 26) \) reported a detailed timeline of the implementation of each component of the transitional care strategy, fewer than one third explicitly described the resources needed to implement the strategy or the training protocols used in the intervention. No studies reported a plan for sustainability or long-term incorporation of the intervention into current clinical practice. Studies also generally failed to include information about the health care system context in which the intervention was conducted. No studies reported on the local quality improvement infrastructure, safety culture, or other important contextual elements that could have influenced the success of the intervention.

The CTI was the only transitional care strategy that was “successfully” implemented and evaluated in multiple settings, including many types of hospitals and integrated and nonintegrated health care systems (26, 43, 55, 67). All other investigations of interventions that reduced 30-day readmissions or ED visits were single-center studies that were not replicated in multiple settings or diverse populations.

Sixteen studies reported comparisons of health care utilization and associated costs for patients in the intervention group and patients receiving usual care. These costs were measured over varying intervals after discharge and used cost estimates from different sources. No studies reported the costs of the intervention itself. We therefore could not draw any firm conclusions on the effect of transitional care interventions on overall health care costs.

Contextual factors probably play a significant role in determining the effectiveness of a transitional care strategy. These contextual factors may operate at the patient level (for example, an individual patient’s readmission risk), the organizational level (such as a hospital’s quality improvement infrastructure and ability to support transitional care interventions), and the health care system level (such as access to primary care). Unfortunately, the studies we identified did not describe these factors. Because CTI was the only strategy evaluated in different patient populations and health care systems, we could not draw conclusions on the effect of context on effectiveness.

DISCUSSION

In this systematic review, we examined 47 studies involving 44 distinct hospital-initiated strategies aimed at reducing postdischarge AEs, ED visits, and readmissions. We identified 15 studies showing that interventions successfully reduced readmission or ED visit rates after discharge, including 8 studies showing that interventions reduced 30-day readmission rates. Nearly all studies used a bridging intervention, and 10 of the 15 used a dedicated transition provider who contacted patients before and after discharge. One of these strategies, the CTI, has been successfully implemented and evaluated in multiple patient populations.
and health care systems; a similar intervention, Project RED, has been implemented in a safety net system. Although these strategies are relatively intensive and probably require considerable resources, information on costs of transitional care strategies was lacking. Because few studies specifically addressed the problem of postdischarge AEs, we could not reach firm conclusions regarding effective strategies in this area.

Two recent systematic reviews (71, 72) also attempted to identify interventions to improve the quality of care transitions at hospital discharge. One of these focused on the clinical handover from hospital to primary care, and the other evaluated transitional care interventions for patients with stroke and acute myocardial infarction. These reviews identified many flaws in the care transitions evidence base that we found as well. These flaws included possible selective reporting; heterogeneity in intervention types, patient populations enrolled, and outcomes measured; limited description of implementation processes; and failure to report on important contextual aspects that may have influenced the success or failure of the transitional care strategy being studied.

Within our classification of interventions, the manner in which the studies carried out specific interventions varied widely. For example, studies that deployed a dedicated transition provider used different types of providers (primarily nurses, but also pharmacists) who had varying levels of contact with patients after discharge (ranging from single telephone calls to multiple home visits). Although many studies enrolled elderly patients or patients considered to be at high risk for readmission, these definitions were also inconsistent. Strategies that involve adding dedicated transition providers probably require considerable resources to implement and sustain effectiveness. However, fewer than one third of studies described the training protocols or resources needed to implement a transitional care strategy, and no studies reported a plan for intervention sustainability.

Although readmission risk is known to be linked to access to primary care and the overall level of health care resources within a community (73), most studies did not include information on the health system context in which the intervention was implemented. In addition, even among the most comprehensive intervention strategies reviewed, there was little evidence of active engagement of primary care providers in the transitional care planning process. Primary care providers and the medical home may be best positioned to detect and prevent AEs before an ED visit or readmission, and thus active engagement of outpatient providers in discharge safety efforts may prove fruitful.

Despite the rapid proliferation of transitional care strategies in the race to reduce hospital readmissions, there has been a notable lack of attention to the potential additional benefit of strategies to reduce specific postdischarge AEs. Postdischarge AEs should also be targeted in quality improvement efforts because they still represent significant failures to ensure patient safety, even if they do not ultimately lead to ED visits or readmissions. Medication safety interventions led by clinical pharmacists seem to be a promising approach, indicating a need for larger trials with an explicit plan to measure clinically significant AEs. Further research in this field should also follow recently published recommendations (74) to standardize intervention nomenclature and reproducibility, identify target populations most likely to benefit from specific interventions, measure patient-centered outcomes, and rigorously report and evaluate cost and implementation factors.

Our study has several limitations. We focused on transitional care strategies initiated during hospitalization for general medical patient populations, and we excluded studies conducted in disease-specific populations. Because current policy initiatives emphasize the role of hospitals in preventing readmissions in all patients, we therefore aimed to identify strategies that hospitals could apply to broad patient populations. Prior systematic reviews (18, 21, 72, 75) have identified interventions that can reduce readmission risk in patients with congestive heart failure, acute myocardial infarction, or stroke, but these conditions collectively account for only about 10% of Medicare hospital admissions per year (2). Thus, a successful disease-specific approach may not translate to reductions in overall readmission rates. Proven disease-specific strategies, such as disease management programs, often rely on customized patient self-management or medication adherence interventions that may be less relevant for other disease processes.

We also included only studies that measured clinically significant AEs, in an effort to emphasize patient-centered outcomes. This led to exclusion of some studies that measured surrogate outcomes, such as studies of discharge medication reconciliation that measured medication discrepancies but did not report data on clinical AEs (76, 77). Some of these strategies may yet prove to be effective at preventing clinical AEs. Finally, publication bias may have affected the results of our review because the national focus on readmissions has catalyzed many efforts to improve transitional care that have yet to be published in the peer-reviewed literature.

Hospitals are now faced with the challenge of reevaluating their current transitional care practices in order to reduce 30-day readmission rates. Although emphasizing readmissions may have good face validity, we believe that policymakers’ focus on 30-day readmissions is problematic. Only a small proportion (approximately 20% from published studies) (78) of readmissions at 30 days are probably preventable, and much of what drives hospital readmission rates are patient- and community-level factors, such as mental illness, poor social support, and poverty, that are well outside the hospital’s control (79, 80). Furthermore, high readmission rates can be the result of low mortality rates, improved access to hospital care, and high admission rates.
rates (81) and therefore may not always represent care transitions failures. Because there are currently no reliable methods to predict an individual patient’s readmission risk (82), hospitals face significant difficulties in determining which patients should be targeted for transitional care interventions. Finally, because hospitals are expending resources on reducing readmissions, they may not be able to address other, more pressing patient safety issues. In this context, our finding that only a few resource-intensive interventions seem to reduce readmission rates is especially problematic.

In summary, we found that only a limited number of bridging interventions involving a dedicated transition provider seems to reduce readmissions and ED visits after hospital discharge to home. Among these, only the CTI has been implemented in multiple settings and patient populations. Few studies specifically targeted AEs after discharge, and the studies we identified provided little information about implementation factors, contextual factors, or cost. Although hospitals are now being penalized for excessive readmission rates, the strategies that an individual hospital can implement to improve transitional care remain largely undefined.

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