

# Hospital-Initiated Transitional Care Interventions as a Patient Safety Strategy

## A Systematic Review

Stephanie Rennke, MD; Oanh K. Nguyen, MD; Marwa H. Shoeb, MD; Yimdriuska Magan, BS; Robert M. Wachter, MD; and Sumant R. Ranji, MD

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 pre-discharge and post-discharge 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 post-discharge 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.

*Ann Intern Med.* 2013;158:433-440.

For author affiliations, see end of text.

[www.annals.org](http://www.annals.org)

## 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. How-

ever, little evidence supports their effect on readmissions or other important markers of post-discharge 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: pre-discharge, post-discharge, and “bridging” (including both pre- and post-discharge components) (Table 1) (15).

We defined post-discharge AEs as any of the following patient experiences—all representing clinically meaningful

See also:

### Web-Only

CME quiz (Professional Responsibility Credit)  
Supplement

**Key Summary Points**

Hospitals are charged with implementing transitional care strategies—interventions initiated before hospital discharge to facilitate the safe transition of patients across health care settings—to prevent adverse events, emergency department visits, and readmissions after discharge.

Hospital-based or bridging (including in-hospital and post-discharge components) strategies to prevent adverse clinical outcomes after discharge can involve patient engagement, use of a dedicated transition provider, medication reconciliation, and facilitation of communication with outpatient providers.

Low-strength evidence shows that use of a bridging intervention incorporating a dedicated transition provider, who contacted patients before and after discharge, reduced emergency department visits and readmission rates in 10 fair-quality studies.

Evidence on the effectiveness of strategies to prevent postdischarge adverse events is scant and inconclusive.

Few studies provide information on contextual factors, cost, or implementation of transitional care strategies.

Although hospitals may be penalized for excessive re-admission rates, strategies to improve the quality of care transitions at hospital discharge for general medical patients remain undefined.

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 rereviewed 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](http://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****Predischarge interventions**

Assessment of risk for adverse events or readmissions  
 Patient engagement (e.g., patient or caregiver education)  
 Creation of an individualized patient record (customized document in lay language containing clinical and educational information for patients' use after discharge)  
 Facilitation of communication with outpatient providers  
 Multidisciplinary discharge planning team  
 Dedicated transition provider (who has in-person or telephone contact with patient before and after discharge)  
 Medication reconciliation

**Postdischarge interventions**

Outreach to patients (including follow-up telephone calls, patient-activated hotlines, and home visits)  
 Facilitation of clinical follow-up (including facilitated ambulatory provider follow-up)  
 Medication reconciliation after discharge

**Bridging interventions**

Inclusion of at least 1 predischarge component and at least 1 postdischarge component

geted individuals according to medication-related indications, including polypharmacy or receipt of a "high-risk" medication; again, these definitions varied across studies. The most common exclusion criteria used in individual studies were the presence of cognitive impairment or dementia ( $n = 15$ ) and lack of fluency in the dominant language of the country in which the intervention took place ( $n = 17$ ). The exclusion of these individuals may limit the generalizability of study findings to specific groups generally considered to be at lower risk for readmission and AEs and may have biased the study toward null results in some cases.

**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, pre-discharge 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.

**Table 2. Summary Strength of Evidence and Findings**

Intervention and Strategies	Total Studies, <i>n</i>	Mean EPOC Score	Studies Reporting ED Visit or Readmission Rate (at Any Time Point), <i>n</i>	Statistically Significant Reduction in Readmissions or ED Visits	Findings
Hospital-only	17	3.53	16	6	Wide variation in types of interventions and providers involved
Bridging strategy	30	4.83	30	12	
Dedicated transition provider	20	4.95	20	10	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
No dedicated transition provider	10	4.6	10	2	Wide variation in types of interventions and providers involved

ED = emergency department; EPOC = Effective Practice and Organisation of Care.

### 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 (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.

From the University of California, San Francisco, San Francisco, California.

**Note:** The Agency for Healthcare Research and Quality reviewed contract deliverables to ensure adherence to contract requirements and quality, and a copyright release was obtained from the Agency for Healthcare Research and Quality before submission of the manuscript.

**Disclaimer:** All statements expressed in this work are those of the authors and should not in any way be construed as official opinions or positions of the University of California, San Francisco; the Agency for Healthcare Research and Quality; or the U.S. Department of Health and Human Services.

**Financial Support:** From the Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services (contract HHS-290-2007-100621).

**Potential Conflicts of Interest:** Dr. Rennke: *Grant (money to self and to institution):* AHRQ; *Support for travel to meetings for the study or other purposes:* AHRQ; *Payment for writing or reviewing the manuscript (money to self and to institution):* AHRQ; *Provision of writing assistance, medicines, equipment, or administrative support (money to institution):* AHRQ; *Consultancy:* Society Hospital of Medicine. Dr. Ranji: *Grant (money to institution):* AHRQ. Dr. Magan: *Grant (money to institution):* AHRQ. Dr. Wachter: *Grant (money to institution):* AHRQ; *Support for travel to meetings for the study or other purposes (money to institution):* AHRQ; *Board membership:* Chair of the American Board of Internal Medicine; *Grants/grants pending (money to institution):* AHRQ; *Payment for lectures including service on speakers' bureaus:* honorarium for lectures from more than 100 health care organizations, mostly on patient safety, health care quality, and hospitalists; *Royalties:* Lippincott Williams & Wilkins, McGraw-Hill; *Payment for development of educational presentations:* QuantiaMD; *Payment for development of educational presentations (money to institution):* IPC-The Hospitalist Company; *Stock/stock options:* PatientSafe Solutions, CRISI, EarlySense; *Other:* Compensation from John Wiley & Sons for

writing "Wachter's World" blog, Benioff endowed chair in hospital medicine, funded by the US-UK Fulbright Commission for a sabbatical at Imperial College London from July to December 2011, unpaid member of the Board of Directors, Quality Committee of Salem Hospital. All other authors have no disclosures. Disclosures can also be viewed at [www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M12-2573](http://www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M12-2573).

**Requests for Single Reprints:** Stephanie Rennke, MD, University of California, San Francisco, UCSF Mount Zion Medical Center, 1600 Divisadero Street, San Francisco, CA 94115-1945; e-mail, [srennke@medicine.ucsf.edu](mailto:srennke@medicine.ucsf.edu).

Current author addresses and author contributions are available at [www.annals.org](http://www.annals.org).

## References

1. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. *N Engl J Med.* 2009;360:1418-28. [PMID: 19339721]
2. Jha AK, Joynt KE, Orav EJ, Epstein AM. The long-term effect of premier pay for performance on patient outcomes. *N Engl J Med.* 2012;366:1606-15. [PMID: 22455751]
3. Forster AJ, Murff HJ, Peterson JF, Gandhi TK, Bates DW. The incidence and severity of adverse events affecting patients after discharge from the hospital. *Ann Intern Med.* 2003;138:161-7. [PMID: 12558354]
4. Kripalani S, LeFevre F, Phillips CO, Williams MV, Basaviah P, Baker DW. Deficits in communication and information transfer between hospital-based and primary care physicians: implications for patient safety and continuity of care. *JAMA.* 2007;297:831-41. [PMID: 17327525]
5. Gleason KM, McDaniel MR, Feinglass J, Baker DW, Lindquist L, Liss D, et al. Results of the Medications at Transitions and Clinical Handoffs (MATCH) study: an analysis of medication reconciliation errors and risk factors at hospital admission. *J Gen Intern Med.* 2010;25:441-7. [PMID: 20180158]
6. Makaryus AN, Friedman EA. Patients' understanding of their treatment plans and diagnosis at discharge. *Mayo Clin Proc.* 2005;80:991-4. [PMID: 16092576]
7. Moore C, McGinn T, Halm E. Tying up loose ends: discharging patients with unresolved medical issues. *Arch Intern Med.* 2007;167:1305-11. [PMID: 17592105]
8. Hasan O, Meltzer DO, Shaykevich SA, Bell CM, Kaboli PJ, Auerbach AD, et al. Hospital readmission in general medicine patients: a prediction model. *J Gen Intern Med.* 2010;25:211-9. [PMID: 20013068]
9. Kirby SE, Dennis SM, Jayasinghe UW, Harris MF. Patient related factors in frequent readmissions: the influence of condition, access to services and patient choice. *BMC Health Serv Res.* 2010;10:216. [PMID: 20663141]
10. Robinson S, Howie-Esquivel J, Vlahov D. Readmission risk factors after hospital discharge among the elderly. *Popul Health Manag.* 2012;15:338-51. [PMID: 22823255]
11. U.S. Department of Health & Human Services. Hospital Compare. 11 October 2012. Accessed at [www.hospitalcompare.hhs.gov](http://www.hospitalcompare.hhs.gov) on 29 November 2012.
12. Rau J. Medicare to penalize 2,211 hospitals for excess readmissions. *Kaiser Health News.* 13 August 2012. Accessed at [www.kaiserhealthnews.org/Stories/2012/August/13/medicare-hospitals-readmissions-penalties.aspx](http://www.kaiserhealthnews.org/Stories/2012/August/13/medicare-hospitals-readmissions-penalties.aspx) on 28 December 2012.
13. HealthCare.gov. Partnership for patients: better care, lower costs. Accessed at [www.healthcare.gov/center/programs/partnership/index.html](http://www.healthcare.gov/center/programs/partnership/index.html) on 29 November 2012.
14. Maynard GA, Budnitz TL, Nickel WK, Greenwald JL, Kerr KM, Miller JA, et al. 2011 John M. Eisenberg Patient Safety and Quality Awards. Mentored implementation: building leaders and achieving results through a collaborative improvement model. *Innovation in patient safety and quality at the national level.* *Jt Comm J Qual Patient Saf.* 2012;38:301-10. [PMID: 22852190]
15. Hansen LO, Young RS, Hinami K, Leung A, Williams MV. Interventions to reduce 30-day rehospitalization: a systematic review. *Ann Intern Med.* 2011; 155:520-8. [PMID: 22007045]

16. Chiu WK, Newcomer R. A systematic review of nurse-assisted case management to improve hospital discharge transition outcomes for the elderly. *Prof Case Manag.* 2007;12:330-6; quiz 337-8. [PMID: 18030153]
17. Mistiaen P, Francke AL, Poot E. Interventions aimed at reducing problems in adult patients discharged from hospital to home: a systematic meta-review. *BMC Health Serv Res.* 2007;7:47. [PMID: 17408472]
18. Naylor MD, Aiken LH, Kurtzman ET, Olds DM, Hirschman KB. The care span: The importance of transitional care in achieving health reform. *Health Aff (Millwood).* 2011;30:746-54. [PMID: 21471497]
19. Parker SG, Peet SM, McPherson A, Cannaby AM, Abrams K, Baker R, et al. A systematic review of discharge arrangements for older people. *Health Technol Assess.* 2002;6:1-183. [PMID: 12065067]
20. Richards S, Coast J. Interventions to improve access to health and social care after discharge from hospital: a systematic review. *J Health Serv Res Policy.* 2003;8:171-9. [PMID: 12869344]
21. Shepperd S, McClaran J, Phillips CO, Lannin NA, Clemson LM, McCluskey A, et al. Discharge planning from hospital to home. *Cochrane Database Syst Rev.* 2010:CD000313. [PMID: 20091507]
22. Forster AJ, Clark HD, Menard A, Dupuis N, Chernish R, Chandok N, et al. Adverse events among medical patients after discharge from hospital. *CMAJ.* 2004;170:345-9. [PMID: 14757670]
23. Shekelle PG, Wachter RM, Pronovost P. Chapter 2. Methods. In: *Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices. Comparative Effectiveness Review.* Prepared by the Southern California-RAND Evidence-based Practice Center under contract no. HHS290200710062I. Rockville, MD: Agency for Healthcare Research and Quality. [In Press].
24. Balaban RB, Weissman JS, Samuel PA, Woolhandler S. Redefining and redesigning hospital discharge to enhance patient care: a randomized controlled study. *J Gen Intern Med.* 2008;23:1228-33. [PMID: 18452048]
25. Bolas H, Brookes K, Scott M, McElnay J. Evaluation of a hospital-based community liaison pharmacy service in Northern Ireland. *Pharm World Sci.* 2004;26:114-20. [PMID: 15085948]
26. Coleman EA, Parry C, Chalmers S, Min SJ. The care transitions intervention: results of a randomized controlled trial. *Arch Intern Med.* 2006;166:1822-8. [PMID: 17000937]
27. Courtney M, Edwards H, Chang A, Parker A, Finlayson K, Hamilton K. Fewer emergency readmissions and better quality of life for older adults at risk of hospital readmission: a randomized controlled trial to determine the effectiveness of a 24-week exercise and telephone follow-up program. *J Am Geriatr Soc.* 2009;57:395-402. [PMID: 19245413]
28. Dellasega CA, Zerbe TM. A multimethod study of advanced practice nurse postdischarge care. *Clin Excell Nurse Pract.* 2000;4:286-93. [PMID: 11858450]
29. Forster AJ, Clark HD, Menard A, Dupuis N, Chernish R, Chandok N, et al. Effect of a nurse team coordinator on outcomes for hospitalized medicine patients. *Am J Med.* 2005;118:1148-53. [PMID: 16194647]
30. Gallagher PF, O'Connor MN, O'Mahony D. Prevention of potentially inappropriate prescribing for elderly patients: a randomized controlled trial using STOPP/START criteria. *Clin Pharmacol Ther.* 2011;89:845-54. [PMID: 21508941]
31. Gillespie U, Alassaad A, Henrohn D, Garmo H, Hammarlund-Udenaes M, Toss H, et al. A comprehensive pharmacist intervention to reduce morbidity in patients 80 years or older: a randomized controlled trial. *Arch Intern Med.* 2009;169:894-900. [PMID: 19433702]
32. Graumlich JF, Novotny NL, Stephen Nace G, Kaushal H, Ibrahim-Ali W, Theivanayagam S, et al. Patient readmissions, emergency visits, and adverse events after software-assisted discharge from hospital: cluster randomized trial. *J Hosp Med.* 2009;4:E11-9. [PMID: 19479782]
33. Jack BW, Chetty VK, Anthony D, Greenwald JL, Sanchez GM, Johnson AE, et al. A reengineered hospital discharge program to decrease rehospitalization: a randomized trial. *Ann Intern Med.* 2009;150:178-87. [PMID: 19189907]
34. Koehler BE, Richter KM, Youngblood L, Cohen BA, Prengler ID, Cheng D, et al. Reduction of 30-day postdischarge hospital readmission or emergency department (ED) visit rates in high-risk elderly medical patients through delivery of a targeted care bundle. *J Hosp Med.* 2009;4:211-8. [PMID: 19388074]
35. Lim WK, Lambert SF, Gray LC. Effectiveness of case management and post-acute services in older people after hospital discharge. *Med J Aust.* 2003;178:262-6. [PMID: 12633482]
36. Lipton HL, Bird JA. The impact of clinical pharmacists' consultations on geriatric patients' compliance and medical care use: a randomized controlled trial. *Gerontologist.* 1994;34:307-15. [PMID: 8076871]
37. Martin F, Oyewole A, Moloney A. A randomized controlled trial of a high support hospital discharge team for elderly people. *Age Ageing.* 1994;23:228-34. [PMID: 8085509]
38. Marusic S, Gojo-Tomic N, Erdeljc V, Bacic-Vrca V, Franic M, Kirin M, et al. The effect of pharmacotherapeutic counseling on readmissions and emergency department visits. *Int J Clin Pharm.* 2012. [PMID: 23007693]
39. Naylor MD, Brooten D, Campbell R, Jacobsen BS, Mezey MD, Pauly MV, et al. Comprehensive discharge planning and home follow-up of hospitalized elders: a randomized clinical trial. *JAMA.* 1999;281:613-20. [PMID: 10029122]
40. Naylor MD. Comprehensive discharge planning for hospitalized elderly: a pilot study. *Nurs Res.* 1990;39:156-61. [PMID: 2188217]
41. Nazareth I, Burton A, Shulman S, Smith P, Haines A, Timberal H. A pharmacy discharge plan for hospitalized elderly patients—a randomized controlled trial. *Age Ageing.* 2001;30:33-40. [PMID: 11322670]
42. Nikolaus T, Specht-Leible N, Bach M, Oster P, Schlierf G. A randomized trial of comprehensive geriatric assessment and home intervention in the care of hospitalized patients. *Age Ageing.* 1999;28:543-50. [PMID: 10604506]
43. Parry C, Min SJ, Chugh A, Chalmers S, Coleman EA. Further application of the care transitions intervention: results of a randomized controlled trial conducted in a fee-for-service setting. *Home Health Care Serv Q.* 2009;28:84-99. [PMID: 20182958]
44. Schnipper JL, Kirwin JL, Cotugno MC, Wahlstrom SA, Brown BA, Tarvin E, et al. Role of pharmacist counseling in preventing adverse drug events after hospitalization. *Arch Intern Med.* 2006;166:565-71. [PMID: 16534045]
45. Scullin C, Scott MG, Hogg A, McElnay JC. An innovative approach to integrated medicines management. *J Eval Clin Pract.* 2007;13:781-8. [PMID: 17824872]
46. Siu AL, Kravitz RL, Keeler E, Hemmerling K, Kington R, Davis JW, et al. Postdischarge geriatric assessment of hospitalized frail elderly patients. *Arch Intern Med.* 1996;156:76-81. [PMID: 8526700]
47. Stewart S, Pearson S, Luke CG, Horowitz JD. Effects of home-based intervention on unplanned readmissions and out-of-hospital deaths. *J Am Geriatr Soc.* 1998;46:174-80. [PMID: 9475445]
48. Thomas DR, Brahan R, Haywood BP. Inpatient community-based geriatric assessment reduces subsequent mortality. *J Am Geriatr Soc.* 1993;41:101-4. [PMID: 8426028]
49. Weinberger M, Oddone EZ, Henderson WG. Does increased access to primary care reduce hospital readmissions? Veterans Affairs Cooperative Study Group on Primary Care and Hospital Readmission. *N Engl J Med.* 1996;334:1441-7. [PMID: 8618584]
50. Finn KM, Heffner R, Chang Y, Bazari H, Hunt D, Pickell K, et al. Improving the discharge process by embedding a discharge facilitator in a resident team. *J Hosp Med.* 2011;6:494-500. [PMID: 22042739]
51. Legrain S, Tubach F, Bonnet-Zamponi D, Lemaire A, Aquino JP, Paillaud E, et al. A new multimodal geriatric discharge-planning intervention to prevent emergency visits and rehospitalizations of older adults: the optimization of medication in AGEd multicenter randomized controlled trial. *J Am Geriatr Soc.* 2011;59:2017-28. [PMID: 22091692]
52. Adler A, Lipkin C, Cooper L, Agolino M, Jones V. Effect of social work intervention on hospital discharge transition planning in a special needs population. *Manag Care.* 2009;18:50-3. [PMID: 19999254]
53. Al-Rashed SA, Wright DJ, Roebuck N, Sunter W, Chrystyn H. The value of inpatient pharmaceutical counselling to elderly patients prior to discharge. *Br J Clin Pharmacol.* 2002;54:657-64. [PMID: 12492615]
54. Brand CA, Jones CT, Lowe AJ, Nielsen DA, Roberts CA, King BL, et al. A transitional care service for elderly chronic disease patients at risk of readmission. *Aust Health Rev.* 2004;28:275-84. [PMID: 15595909]
55. Coleman EA, Smith JD, Frank JC, Min SJ, Parry C, Kramer AM. Preparing patients and caregivers to participate in care delivered across settings: the Care Transitions Intervention. *J Am Geriatr Soc.* 2004;52:1817-25. [PMID: 15507057]
56. Cowan MJ, Shapiro M, Hays RD, Afifi A, Vazirani S, Ward CR, et al. The effect of a multidisciplinary hospitalist/physician and advanced practice nurse collaboration on hospital costs. *J Nurs Adm.* 2006;36:79-85. [PMID: 16528149]
57. Einstadter D, Cebul RD, Franta PR. Effect of a nurse case manager on postdischarge follow-up. *J Gen Intern Med.* 1996;11:684-8. [PMID: 9120655]

58. Gow P, Berg S, Smith D, Ross D. Care co-ordination improves quality-of-care at South Auckland Health. *J Qual Clin Pract.* 1999;19:107-10. [PMID: 10408752]
59. Hellström LM, Bondesson A, Höglund P, Midlöv P, Holmdahl L, Rickhag E, et al. Impact of the Lund Integrated Medicines Management (LIMM) model on medication appropriateness and drug-related hospital revisits. *Eur J Clin Pharmacol.* 2011;67:741-52. [PMID: 21318595]
60. Hogan DB, Fox RA. A prospective controlled trial of a geriatric consultation team in an acute-care hospital. *Age Ageing.* 1990;19:107-13. [PMID: 2337005]
61. Makowsky MJ, Koshman SL, Midodzi WK, Tsuyuki RT. Capturing outcomes of clinical activities performed by a rounding pharmacist practicing in a team environment: the COLLABORATE study [NCT00351676]. *Med Care.* 2009;47:642-50. [PMID: 19433997]
62. Mudge A, Laracy S, Richter K, Denaro C. Controlled trial of multidisciplinary care teams for acutely ill medical inpatients: enhanced multidisciplinary care. *Intern Med J.* 2006;36:558-63. [PMID: 16911547]
63. Palmer HC Jr, Halperin A, Elnicki M, Powers R, Kolar M, Evans K, et al. Effect of a patient care partnership project on cost and quality of care at an academic teaching hospital. *South Med J.* 2002;95:1318-25. [PMID: 12540000]
64. Scullin C, Hogg A, Luo R, Scott MG, McElnay JC. Integrated medicines management—can routine implementation improve quality? *J Eval Clin Pract.* 2012;18:807-15. [PMID: 21504517]
65. Steeman E, Moons P, Milisen K, De Bal N, De Geest S, De Froidmont C, et al. Implementation of discharge management for geriatric patients at risk of readmission or institutionalization. *Int J Qual Health Care.* 2006;18:352-8. [PMID: 16861721]
66. Styrborn K. Early discharge planning for elderly patients in acute hospitals—an intervention study. *Scand J Soc Med.* 1995;23:273-85. [PMID: 8919370]
67. Voss R, Gardner R, Baier R, Butterfield K, Lehrman S, Gravenstein S. The care transitions intervention: translating from efficacy to effectiveness. *Arch Intern Med.* 2011;171:1232-7. [PMID: 21788540]
68. Walker PC, Bernstein SJ, Jones JN, Piersma J, Kim HW, Regal RE, et al. Impact of a pharmacist-facilitated hospital discharge program: a quasi-experimental study. *Arch Intern Med.* 2009;169:2003-10. [PMID: 19933963]
69. Wilkinson ST, Pal A, Couldry RJ. Impacting readmission rates and patient satisfaction: results of a discharge pharmacist pilot program. *Hospital Pharm.* 2011;46:876-83.
70. Al-Ghamdi SA, Mahmoud MA, Alammari MA, Al Bekairy AM, Alwhaibi M, Mayet AY, et al. The outcome of pharmacist counseling at the time of hospital discharge: an observational nonrandomized study. *Ann Saudi Med.* 2012;32:492-7. [PMID: 22871618]
71. Hesselink G, Schoonhoven L, Barach P, Spijker A, Gademan P, Kalkman C, et al. Improving patient handovers from hospital to primary care: a systematic review. *Ann Intern Med.* 2012;157:417-28. [PMID: 22986379]
72. Prvu Bettger J, Alexander KP, Dolor RJ, Olson DM, Kendrick AS, Wing L, et al. Transitional care after hospitalization for acute stroke or myocardial infarction: a systematic review. *Ann Intern Med.* 2012;157:407-16. [PMID: 22986378]
73. Epstein AM, Jha AK, Orav EJ. The relationship between hospital admission rates and rehospitalizations. *N Engl J Med.* 2011;365:2287-95. [PMID: 22168643]
74. Bray-Hall ST. Transitional care: focusing on patient-centered outcomes and simplicity [Editorial]. *Ann Intern Med.* 2012;157:448-9. [PMID: 22986380]
75. Takeda A, Taylor SJ, Taylor RS, Khan F, Krum H, Underwood M. Clinical service organisation for heart failure. *Cochrane Database Syst Rev.* 2012;9:CD002752. [PMID: 22972058]
76. Karapinar-Carkit F, Borgsteede SD, Zoer J, Smit HJ, Egberts AC, van den Bemt PM. Effect of medication reconciliation with and without patient counseling on the number of pharmaceutical interventions among patients discharged from the hospital. *Ann Pharmacother.* 2009;43:1001-10. [PMID: 19491320]
77. Schnipper JL, Hamann C, Ndumele CD, Liang CL, Carty MG, Karson AS, et al. Effect of an electronic medication reconciliation application and process redesign on potential adverse drug events: a cluster-randomized trial. *Arch Intern Med.* 2009;169:771-80. [PMID: 19398689]
78. van Walraven C, Jennings A, Taljaard M, Dhalla I, English S, Mulpuru S, et al. Incidence of potentially avoidable urgent readmissions and their relation to all-cause urgent readmissions. *CMAJ.* 2011;183:E1067-72. [PMID: 21859870]
79. Joynt KE, Orav EJ, Jha AK. Thirty-day readmission rates for Medicare beneficiaries by race and site of care. *JAMA.* 2011;305:675-81. [PMID: 21325183]
80. Philbin EF, Dec GW, Jenkins PL, DiSalvo TG. Socioeconomic status as an independent risk factor for hospital readmission for heart failure. *Am J Cardiol.* 2001;87:1367-71. [PMID: 11397355]
81. Fisher ES, Wennberg JE, Stukel TA, Sharp SM. Hospital readmission rates for cohorts of Medicare beneficiaries in Boston and New Haven. *N Engl J Med.* 1994;331:989-95. [PMID: 8084356]
82. Kansagara D, Englander H, Salanitro A, Kagen D, Theobald C, Freeman M, et al. Risk prediction models for hospital readmission: a systematic review. *JAMA.* 2011;306:1688-98. [PMID: 22009101]



**Current Author Addresses:** Dr. Rennke: University of California, San Francisco, UCSF Mount Zion Medical Center, 1600 Divisadero Street, San Francisco, CA 94115-1945.

Dr. Nguyen: University of California, San Francisco, UCSF Laurel Heights, Campus Box 1211, 3333 California Street, San Francisco, CA 94143.

Drs. Shoeb and Ranji: Department of Medicine, University of California, San Francisco, 533 Parnassus Avenue, Box 0131, San Francisco, CA 94143.

Dr. Magan: Division of Hospital Medicine, University of California, San Francisco, 533 Parnassus Avenue, Box 0131, U-129, San Francisco, CA 94143.

Dr. Wachter: Department of Medicine, University of California, San Francisco, 533 Parnassus Avenue, Box 0120, San Francisco, CA 94143.

**Author Contributions:** Conception and design: S. Rennke, O.K. Nguyen, M.H. Shoeb, S.R. Ranji.

Analysis and interpretation of the data: S. Rennke, O.K. Nguyen, M.H. Shoeb, Y. Magan, S.R. Ranji.

Drafting of the article: S. Rennke, O.K. Nguyen, M.H. Shoeb, Y. Magan, S.R. Ranji.

Critical revision of the article for important intellectual content: S. Rennke, O.K. Nguyen, M.H. Shoeb, Y. Magan, R.M. Wachter, S.R. Ranji.

Final approval of the article: S. Rennke, O.K. Nguyen, M.H. Shoeb, R.M. Wachter, S.R. Ranji.

Obtaining of funding: R.M. Wachter.

Administrative, technical, or logistic support: Y. Magan.

Collection and assembly of data: S. Rennke, O.K. Nguyen, M.H. Shoeb, Y. Magan, S.R. Ranji.