

Improving Patient Handovers From Hospital to Primary Care

A Systematic Review

Gijs Hesselink, MA, MSc; Lisette Schoonhoven, RN, PhD; Paul Barach, MD, MPH; Anouk Spijker, MA; Petra Gademan, MD; Cor Kalkman, MD, PhD; Janine Liefers, MSc; Myrra Vernooij-Dassen, PhD; and Hub Wollersheim, MD, PhD

Background: Evidence shows that suboptimum handovers at hospital discharge lead to increased rehospitalizations and decreased quality of health care.

Purpose: To systematically review interventions that aim to improve patient discharge from hospital to primary care.

Data Sources: PubMed, CINAHL, PsycInfo, the Cochrane Library, and EMBASE were searched for studies published between January 1990 and March 2011.

Study Selection: Randomized, controlled trials of interventions that aimed to improve handovers between hospital and primary care providers at hospital discharge.

Data Extraction: Two reviewers independently abstracted data on study objectives, setting and design, intervention characteristics, and outcomes. Studies were categorized according to methodological quality, sample size, intervention characteristics, outcome, statistical significance, and direction of effects.

Data Synthesis: Of the 36 included studies, 25 (69.4%) had statistically significant effects in favor of the intervention group and 34 (94.4%) described multicomponent interventions. Effective interventions included medication reconciliation; electronic tools to fa-

cilitate quick, clear, and structured summary generation; discharge planning; shared involvement in follow-up by hospital and community care providers; use of electronic discharge notifications; and Web-based access to discharge information for general practitioners. Statistically significant effects were mostly found in reducing hospital use (for example, rehospitalizations), improvement of continuity of care (for example, accurate discharge information), and improvement of patient status after discharge (for example, satisfaction).

Limitations: Heterogeneity of the interventions and study characteristics made meta-analysis impossible. Most studies had diffuse aims and poor descriptions of the specific intervention components.

Conclusion: Many interventions have positive effects on patient care. However, given the complexity of interventions and outcome measures, the literature does not permit firm conclusions about which interventions have these effects.

Primary Funding Source: The European Union, the Framework Programme of the European Commission.

Ann Intern Med. 2012;157:417-428.

For author affiliations, see end of text.

www.annals.org

When a patient's transition from the hospital to home is suboptimum, the repercussions can be far-reaching—rehospitalization, adverse medical events, and even death (1). Several studies over the past decade have identified deficits in communication and information transfer between hospital and primary care providers (2–6). Ineffective handovers at hospital discharge seriously impede the quality and safety of patient care. Forster and colleagues (7) demonstrated that 1 in 5 patients has an adverse event after being discharged. Approximately 62% of these adverse events, which ranged from serious laboratory abnormalities to permanent disabilities, could have been prevented or alleviated (7). Inadequate handovers at hospital discharge also lead to unanticipated rehospitalizations (5, 8) and overwhelm emergency departments with unplanned visits (9).

The need for effective patient discharge from the hospital is increasing because of the rising number of transitions of elderly and chronically ill patients between various health care institutions, the trend toward shorter hospital stays, and the growing effort to deliver care in the community (10–13). Despite the increasing awareness of the need to improve handovers from hospital to primary care providers (1, 6), a comprehensive evaluation of the effectiveness of interventions is lacking. A review by Kripalani and colleagues (6) focused on the prevalence of deficits in communication and information transfer between hospital and primary care physicians and the effectiveness of interven-

tions. However, the review included only 3 randomized, controlled trials (RCTs).

Hansen and colleagues (14) recently reviewed the effect of interventions on 1 specific outcome (the reduction of rehospitalizations within 30 days) and showed that no intervention was regularly associated with reduced rehospitalizations if implemented alone. Other reviews mainly examined the effect of 1 specific type of intervention at hospital discharge (15, 16) or interventions that sought to improve handovers in the hospital (17, 18), in specific patient groups (19), at referral (20), and among care providers and patients and their relatives (21–23). The aim of this study is to systematically review interventions that were tested in RCTs and that aimed to improve patient handovers from hospital to primary care and to evaluate the overall effects of these interventions.

See also:

Print

Editorial comment. 448
Related article. 407

Web-Only

CME quiz (preview on page I-32)

METHODS

Data Sources

We searched for English-language studies published between 1990 and 1 March 2011 using the following full-text databases: PubMed (including MEDLINE), CINAHL, PsycInfo, the Cochrane Library, and EMBASE. **Appendix Table 1** (available at www.annals.org) provides a detailed listing of search terms. The references of the selected studies were manually checked to identify additional relevant studies that were missed in the database search.

Study Selection

Two reviewers independently assessed inclusion eligibility of the retrieved studies using the search strategy. The initial selection for inclusion was based on the title and abstract of the study. When the title and abstract provided insufficient information to determine the relevance, a full-text copy of the article was retrieved and reviewed. For the final selection, a full-text copy of the study was examined to determine whether it fulfilled the inclusion criteria. Disagreement about inclusion was solved by discussion. When no consensus could be achieved, a third reviewer made the final decision. Each study had to meet 4 criteria to be included in this review. First, it had to be an RCT that was published between January 1990 and 1 March 2011 as a full-text article or dissertation with an English-language title and abstract. Second, it had to examine patients and care providers involved in the transition of care from hospital to primary care or home care. Studies that involved patients with a psychiatric diagnosis, patients younger than 18 years, and pregnant women were excluded. Third, it had to have an intervention explicitly describing 1 or more components that aimed to improve the handover of care between hospital and primary care providers during hospital discharge (before, during, or after physical transition of the patient) within country borders. Fourth, it had to have at least 1 outcome measure addressing the quality or safety of the handover process or outcomes of handovers within the first 3 months after discharge from the hospital. Studies that examined only health care service expenditures and costs were excluded.

Quality Assessment of Methods

After study search and selection criteria were discussed and agreed on, 2 reviewers independently assessed the methodological quality of the full-text studies and discussed the results for consensus. The Cochrane Group's predesigned table (24) was used and modified to ensure standardized scoring. Methodological quality was assessed on the basis of selection bias (method of randomization, allocation concealment, and inclusion and exclusion criteria specified and similarity of groups at baseline), performance bias (assessors blinded to outcome), attrition bias (studies that described characteristics of participants lost to follow-up or were intention-to-treat analyses), and detection bias (power calculation and valid outcome measures). The blinding of participants in the studies was not in-

cluded as a quality criterion because it is impossible to adequately blind participants in the complex social interventions included in this review. The decision about whether the criteria were fulfilled was resolved by discussion. Studies scored 1 point for each fulfilled criterion. If assessment was impossible, the quality element under consideration was labeled "not possible." If information was inadequate or unknown, the decision was labeled "unknown." Studies were excluded if they scored 3 points or fewer.

Data Extraction

Each article that met study eligibility criteria was independently abstracted by 2 reviewers using a standardized form modified from a checklist developed by Grimshaw and colleagues (25). The data extracted from the studies comprised a description of objectives, design, participants, intervention, and effect measures. Any disagreement was resolved by discussion among the reviewers, and a final decision was made by the third reviewer.

Data Synthesis and Analysis

We organized study outcomes in tabular form and made a qualitative assessment based on the methodological quality, sample size, intervention characteristics, outcome, statistical significance, and direction of effects observed. The interventions were classified on the basis of the components of the intervention that aimed to improve discharge handover. The classification was adapted from the definition of continuity of care by Hellesø and colleagues (3), consisting of the following elements that determine quality and safety of handovers between hospital and primary care providers: information (the quality of information that is exchanged between hospital and primary care providers in terms of completeness, accuracy, and clarity), coordination of care (the quality of assessment, planning, and organization of follow-up services and needs), and communication (the quality of exchanging information in terms of personal and direct contact, accessibility, and timeliness).

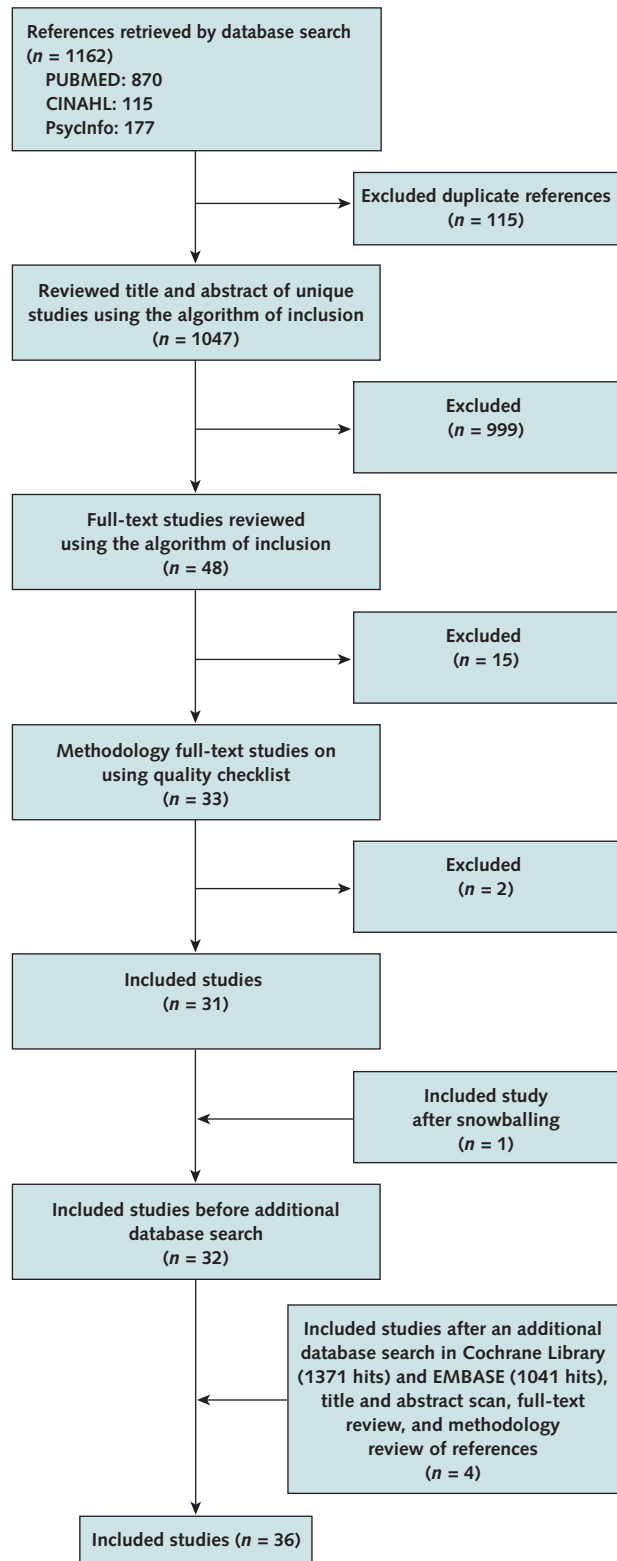
Role of the Funding Source

The Framework Programme of the European Commission, European Union, provided funding for the study. The funding source did not participate in study conception, data collection, analyses, manuscript preparation, the decision to submit the manuscript for publication, or any other part of the study.

RESULTS

Search Results

Our initial search identified 1162 citations (**Figure**), of which 870 were in PubMed, 115 were in CINAHL, and 177 were in PsycInfo. The title and abstract scan resulted in 48 papers that, at first glance, met the inclusion criteria or raised doubt. Fifteen papers were excluded after full-text scan, and 2 more were excluded on the basis of poor methodological quality scores of 3 or less (26, 27). One additional paper was identified by manual review of the

Figure. Summary of evidence search and selection.

reference lists of the original 48 papers. A search in the Cochrane Library and EMBASE resulted in 4 more papers that met our inclusion criteria and quality assessment criteria. Thus, the final set consisted of 36 published studies that underwent full-text abstraction. Because of heterogeneity of the study designs, participants, and outcome measures, meta-analysis was not possible.

Methodological Quality

Overall methodological quality of the studies (Appendix Table 3, available at www.annals.org) was relatively high: Scores ranged from 2 to 9 (mean fulfilled criteria [\pm SE], 6.8 ± 1.7). Application of the quality assessment criteria also demonstrated several limitations. In 12 of the 36 included studies (33.3%), assessors were not blinded to outcome, and in 10 of the studies (27.8%), blinding status was unclear. In 10 studies (27.8%), the intervention and control groups were not similar at baseline. Ten studies (27.8%) did not report the characteristics of participants lost to follow-up. Nearly half of the studies (44.4%; 16 studies) involved an intervention group of fewer than 100 participants.

Characteristics of Included Studies

Appendix Table 2 (available at www.annals.org) summarizes the characteristics of the included studies, stratified by outcome. The main population of the studies consisted of elderly patients (in 18 studies) with various diagnoses (general medical, surgical, heart failure, geriatric, stroke, and breast cancer). Patients were discharged from acute, general medical, cardiac, surgical, and long-stay service from various types of hospitals (urban care, secondary care, tertiary care, teaching, and university-affiliated). The sample size ranged from 20 to 1098 participants for the intervention groups and from 14 to 1107 participants for the control groups.

The studies reported various outcomes (Tables 1 and 2). Most studies reported 1 or more outcomes related to hospital use (28, 32, 35, 36, 39, 40, 42, 45–51, 54, 55, 57, 60, 62, 63), continuity of care (28, 29, 31, 33, 35, 37, 39–41, 44–47, 49, 52, 57–59, 61), and patient status (30, 32, 33, 35, 40, 42, 43, 45, 46, 51–59, 62). Other studies reported 1 or more outcomes related to errors, near-misses, and adverse events (30, 31, 34, 37, 38, 45, 47, 49); use of primary care (35, 44, 48, 57); health care provider status (37, 58); and caregiver status (52, 53).

Intervention Characteristics of Included Studies

All but 2 studies (29, 39) had multicomponent interventions that used a comprehensive program, model, protocol, information and communication technology, or a liaison with a range of specific activities and tools. Table 3 provides a more descriptive overview of the intervention characteristics. Furthermore, 26 studies consisted of interventions performed by designated care providers (for example, case managers, liaisons, or multidisciplinary teams) using aspects of case management. The interventions were applied only during hospitalization (2 studies), at discharge

Table 1. Classification of Outcome Measures Used in Included Studies

Outcome	Examples of Specific Outcome Measures Used in Studies
Hospital use	Postdischarge rehospitalizations Unplanned rehospitalizations Hospitalizations ED visits Length of hospital stay
Continuity of care*	GP knowledge of patient's hospital experiences Completeness of discharge summary Timeliness of discharge summary receipt by GP Medication reconciliation Better patient management by GPs
Patient status	Quality of life Satisfaction Perception of discharge preparedness Self-perceived medication understanding Medication adherence Functional ability Death
Errors/near-misses/adverse events†	Mismatch in drug name, dose, or frequency prescribed in discharge letter and by GP Medication discrepancies (between hospital and community pharmacy records) Preventable adverse outcomes/events Medication prescription error Any medication discrepancy
Primary care use	Follow-up visits by GP More actions initiated by GP on receipt of information
Health care provider status	GP confidence in management of patients' future problems Hospital staff satisfaction with method of summary generation
Caregiver status	Caregiver strain related to care provision

ED = emergency department; GP = general practitioner.
 * Adapted from the definition by Hellesø and colleagues (3) (outcomes that relate to the quality of information, communication, and coordination of care).
 † Unintended occurrences in handover of care potentially causing harm to the patient (prospectively and retrospectively registered).

(5 studies), after discharge (6 studies), or a combination of 2 stages (14 studies) or all 3 stages (7 studies). For 2 studies, this was unclear (37, 44).

Specific Components of Effective Interventions

Statistically significant effects in favor of the intervention group in 1 or more outcomes were found in 25 of the 36 studies reviewed (Appendix Table 2 and Table 2). Further details about the effects of the interventions are given in Appendix Table 2.

Information Shared Between Providers

Fourteen of the 22 studies examining an intervention with a focus on improving the quality of the information exchanged at discharge showed a statistically significant improvement in continuity of care (33, 35, 40, 44, 46, 47, 49, 58, 61); hospital use (35, 36, 40, 45, 49, 51, 63); patient status (33, 35, 40, 43, 46, 51, 63); errors, near-misses, or adverse events (45, 47); and primary care use (35). In these 14 studies, the activities related to improving the quality of the information exchanged involved medica-

tion reconciliation by a hospital pharmacist, study pharmacist, liaison pharmacist, or community pharmacist (35, 36, 43, 45, 47, 49); medical information reconciliation without a pharmacist (33, 40, 46, 51, 63); electronic templates as the primary method of information sharing (45, 46); database-generated discharge summaries comprising structured formats to organize information (61); clinical decision support, alerts for pending results, and online reference information (33); and such other tools as pick lists for standard drug doses and required fields to facilitate quick, clear, and structured data entry (33).

Coordination of Care

Twenty of the 27 studies examining an intervention with a focus on improving coordination of care showed a statistically significant improvement in continuity of care (31, 33, 35, 40, 44, 46, 49, 52, 58, 59), hospital use (35, 36, 40, 48, 49, 51, 55, 60, 63), patient status (32, 33, 35, 40, 43, 46, 51, 53–55, 59, 63), and primary care use (35). These studies described such intervention activities as organizing postdischarge services or follow-up (35, 46, 48, 53, 54, 60); a discharge planning protocol (the mandate to discharge patients without the need for physician input or written orders) (40); early assessment of follow-up needs and resources (32, 48, 54); negotiated postoperative involvement by hospital-based nurses with community care providers (52); general practitioner (GP) input into discharge planning (59); postdischarge check for follow-up needs, adjustments, and arrangements (31, 54); and creation of a discharge plan containing follow-up needs and arrangements and planned appointments and recommendations (35, 46, 48, 51, 53, 60, 63).

Communication

Twenty-two of the 31 studies examining an intervention with a focus on improving communication showed a statistically significant improvement in continuity of care (29, 33, 35, 39, 44, 46, 47, 49, 52, 58, 59, 61), hospital use (35, 36, 45, 48, 49, 51, 60, 63), patient status (33, 35, 43, 46, 51, 53–55, 59, 63), and primary care use (35). Studies explicitly described interventions with a liaison nurse or liaison pharmacist to improve communication with community care providers (43, 47, 52, 53) and the use of fax (33, 35, 36, 46, 47, 49, 52) or e-mail (29, 45) to transmit discharge summaries, plans, and other relevant information in a timely manner (for example, on the day of discharge). Afilalo and colleagues (44) and Tripp (39) described electronic notifications to inform GPs about patient hospital visits and available discharge information, respectively, and to give them Web-based access to discharge information (for example, planning and medication regimen). Rutherford and Burge (58) described use of a personal invitation by telephone for GPs to visit the hospital at patient admission or to telephone hospital staff for assistance in discharge planning. Harrison and associates

Table 2. Types of Outcomes and Statistical Significance of Effects, by Studied Interventions

Intervention (Reference)	Outcome						
	Hospital Use	Continuity of Care*	Patient Status	Errors/Near-Misses/Adverse Events†	Primary Care Use	Health Care Provider Status	Caregiver Status
Geriatric floating interdisciplinary transition team (28)	✓	✓					
Delivery of electronic discharge summary by e-mail (29)		✓‡					
Clinical pharmacist discharge service (30)			✓	✓			
Comprehensive discharge follow-up (31)		✓‡		✓‡			
Interdisciplinary intervention program (32)	✓		✓‡				
Software-assisted hospital discharge: computerized physician order entry (33)		✓‡	✓‡				
Software-assisted hospital discharge: computerized physician order entry (34)				✓			
Reengineered hospital discharge program (35)	✓‡	✓‡	✓‡		✓‡		
Supplemental care bundle (36)	✓‡						
Electronic discharge summary program (37)		✓		✓		✓	
Computerized medication reconciliation tool and process redesign (38)				✓			
Notification to inform GPs of discharge summary documentation (39)	✓	✓‡					
Nurse-driven, evidence-based discharge planning protocol (40)	✓‡	✓‡	✓‡				
Enhanced medication discharge plan (41)		✓					
Stroke discharge care case management (42)	✓		✓				
Community liaison pharmacy service (43)			✓‡				
Standardized Web-based communication system between GPs and ED (44)		✓‡			✓‡		
Enhanced pharmacist counseling and follow-up (45)	✓‡	✓	✓	✓‡			
Hospital-coordinated discharge care plan (46)	✓	✓‡	✓‡				
Hospital-based community liaison pharmacy service (47)	✓	✓‡		✓‡			
Comprehensive Geriatric Assessment and multidisciplinary intervention (48)	✓‡				✓		
Pharmacist transition coordinator (49)	✓‡	✓‡		✓			
Intensive community nurse-supported discharge program (50)	✓						
APN-directed discharge planning and home follow-up protocol (51)	✓‡		✓‡				
Nurse-led early discharge (52)		✓‡	✓				✓
Case management and post-acute care program (53)			✓‡				✓
Comprehensive follow-up home visits (54)	✓		✓‡				
Hospital-to-home transitional care model (55)	✓‡		✓‡				
Extended stroke service unit with early supported discharge (56)			✓				
Pharmacy discharge plan (57)	✓	✓	✓		✓		
Personal invitation to GPs to visit or contact hospital and a special discharge summary (58)		✓‡	✓			✓	
GP input into discharge planning (59)		✓‡	✓‡				
APN-centered comprehensive discharge planning and home follow-up protocol (60)	✓‡						
Database-generated discharge summaries (61)		✓‡					
Postdischarge geriatric assessment (62)	✓		✓				
Comprehensive multidisciplinary treatment strategy (63)	✓‡						
Total	20	19	19	8	4	2	2

APN = advanced practice nurse; ED = emergency department; GP = general practitioner.

* Adapted from the definition by Helleso and colleagues (3) (outcomes that relate to the quality of information, communication, and coordination of care).

† Unintended occurrences in handover of care potentially causing harm to the patient (prospectively and retrospectively registered).

‡ Outcome with statistically significant effect in favor of the intervention group.

(55) described telephone outreach from hospital to home care (within 24 hours after discharge) to notify the primary contact for follow-up consultation, whereas Wells and colleagues (52) described a mobile telephone hotline ensuring 24-hour access to a breast care nurse. Other common effective handover activities were face-to-face meetings in the community or hospital (49, 51, 54, 63), case conferences by telephone (63), or both (60).

DISCUSSION

To our knowledge, this is the first systematic review of RCTs evaluating the effects of interventions to improve patient handovers between hospital and primary care providers at discharge. Our systematic review of the literature

found that most interventions (34 of 36) were multicomponent and most studies (25 of 36) had statistically significant effects in favor of the intervention group in 1 or more outcomes.

We found that efforts are primarily aimed at facilitating the coordination of care and communication between hospital and primary care providers and pharmacists. Limited evidence suggests that effective discharge interventions consist of components or activities that focus on structuring and reconciling discharge information, coordinating follow-up care, and direct and timely communication between providers. Discharge interventions were mainly effective for reducing hospital use (for example, rehospitalizations or emergency department visits), aspects that

Table 3. Intervention Characteristics

Study, Year (Reference)	Intervention	Relevant Actions
Arbaje et al, 2010 (28)	Geriatric floating interdisciplinary transition team	Patient discharge needs assessment with case manager and rehabilitation therapists; 1-page summary of hospitalization and care plan faxed to GP
Chen et al, 2010 (29)	Delivery of electronic discharge summary by e-mail	Discharge summaries sent by e-mail
Eggink et al, 2010 (30)	Clinical pharmacist discharge service	Review of discharge medication; communicating prescribing errors to the cardiologist; giving patients information; preparation of a written overview of the discharge medication and communication to both the community pharmacist and the GP about this medication
Rytter et al, 2010 (31)	Comprehensive discharge follow-up	Structured home visits by GP and district nurse; checking discharge letter for follow-up needs, adjustments, and arrangements
Shyu et al, 2010 (32)	Interdisciplinary intervention program	Predischarge assessment of resources and needs; organization of follow-up (referrals), if needed
Graumlich et al, 2009 (33, 34)*	Software-assisted hospital discharge: computerized physician order entry	Clinical decision support; required fields; use of pick lists; standard drug doses; alerts (e.g., pending results at discharge); reminders; online reference information; reconciliation of information (medication); discharge documents automatically generated and sent by fax and postal mail
Jack et al, 2009 (35)	Reengineered hospital discharge program	Creation of comprehensive discharge plan; transmitting discharge summary and discharge plan to GP on day of discharge by fax; reconciliation of information (medication); organizing postdischarge services/follow-up
Koehler et al, 2009 (36)	Supplemental care bundle	Medication reconciliation by study pharmacist; additional time for study care coordinator to identify and address discharge barriers and needs; supplemental structured discharge form given to patient and faxed to GP
Maslove et al, 2009 (37)	Electronic discharge summary program	Discharge information grouped and structured into 3 separate sections; completing sections by combination of free-text entry, pick lists, and cutting and pasting from electronic patient record; generated summaries electronically signed and authenticated by attending physician, uploaded to hospital information system, and sent to the GPs
Schnipper et al, 2009 (38)	Computerized medication reconciliation tool and process redesign	Creation of a PML from several electronic sources; facilitates reconciliation of the PML with current inpatient medications when discharge orders are written; requires confirmation that the PML has been reconciled with discharge medications
Tripp, 2009 (39)	Notification to inform GPs of discharge summary documentation	Automatic notification to GP named in patient's admission record when new discharge summary is stored in patient's EMR
King, 2008 (40)	Nurse-driven, evidence-based discharge planning protocol	Discharge planning protocol; medication reconciliation; discharge without the need for physician input or written orders
Lalonde et al, 2008 (41)	Enhanced MDP	Creation of MDP; reconciliation of information (medication); transmitting MDP to community physician/pharmacist
Mayo et al, 2008 (42)	Stroke discharge care case management	Contact with the patient's personal community physician for arranging an appointment and for documentation about the stroke to be forwarded to the personal physician; organizing postdischarge services/follow-up
Vuong et al, 2008 (43)	Community liaison pharmacy service	Verbal handover from ward to CLP, including the patient's inpatient care plan, discharge summary, and list of discharge medications; home visit from a CLP where any difficulties and potential problems had by the patients were rectified or highlighted for primary care provider intervention; a structured, preformatted consultation report transmitted to relevant primary care providers and accompanied by a brief letter explaining the study and the purpose of the service; direct telephone contact or face-to-face meetings when needed
Afilalo et al, 2007 (44)	Standardized, Web-based, communication system between GPs and ED	Daily advisory or immediate e-mails (to alert GPs that their patient presented to the ED); e-mails provide a link to a secure Web site where the GP can view and print the medical report (including discharge planning information and changes in medication regimen)
Schnipper et al, 2006 (45)	Enhanced pharmacist counseling and follow-up	Reconciliation of information (medication); use of EMRs; communication via standard electronic template (e-mail)
Preen et al, 2005 (46)	Hospital-coordinated discharge care plan	Creation of discharge plan; communication via standard electronic template; reconciliation of information (discharge care plan); organizing postdischarge services/follow-up; discharge plan faxed to community care providers
Bolas et al, 2004 (47)	Hospital-based community liaison pharmacy service	Reconciliation of information (medication); streamlining medication regimens; discharge letter signed off on by junior physician; pharmaceutical discharge letter faxed to community physician and pharmacist at day of discharge
Caplan et al, 2004 (48)	Comprehensive Geriatric Assessment and multidisciplinary intervention	Conducting discussion with GP; creation of discharge plan; assessing needs and initiating or referring to postdischarge services/follow-up
Crotty et al, 2004 (49)	Pharmacist transition coordinator	Discharge summary faxed to community physician and pharmacist on patient's discharge; reconciliation of information (medication); case conference (providing GP and community pharmacist with information about medication use and appropriateness and issues that require monitoring)
Kwok et al, 2004 (50)	Intensive CN-supported discharge program	Organizing postdischarge services/follow-up; close liaison between CN and hospital physicians (telephone hotline; pager)

Table 3—Continued

Key Players	Setting	Classification of Intervention		
		Information	Coordination	Communication
Geriatric nurse practitioner, geriatrician	During hospitalization; after discharge		✓	✓
Resident medical staff, GPs	At discharge; after discharge			✓
Clinical pharmacist	During hospitalization; at discharge	✓		✓
GPs, district nurses	After discharge		✓	
Geriatric nurse, geriatrician	During hospitalization		✓	
Hospital physicians	At discharge	✓	✓	✓
Nurse discharge advocates, hospital pharmacists	During hospitalization; at discharge	✓	✓	✓
Study care coordinator, study pharmacist	Unknown; at discharge	✓	✓	✓
Attending hospital physician, housestaff	Unknown	✓		✓
Hospital physicians, hospital nurses	At discharge	✓		
Hospital providers, GPs	Unknown; at discharge			✓
Intervention registered nurses, principal investigator, electrophysiology physicians	During hospitalization; at discharge; after discharge	✓	✓	
Hospital pharmacists	During hospitalization; at discharge	✓	✓	✓
Two nurses (case manager)	At discharge; after discharge	✓	✓	✓
Two qualified clinical pharmacists	After discharge	✓	✓	✓
ED physicians, GPs	Unknown	✓	✓	✓
Hospital pharmacists	At discharge; after discharge	✓		✓
Research nurses, GPs	During hospitalization; at discharge; after discharge	✓	✓	✓
Liaison pharmacist	During hospitalization; at discharge; after discharge	✓		✓
Geriatric nurse (case manager), multi-disciplinary outreach team, and GP	After discharge		✓	✓
Pharmacist transition coordinator, community physician and pharmacist, registered nurse of long-term stay facility	At discharge; after discharge	✓	✓	✓
Designated CN	After discharge		✓	✓

Table 3—Continued

Study, Year (Reference)	Intervention	Relevant Actions
Naylor et al, 2004 (51)	APN-directed discharge planning and home follow-up protocol	Creation of discharge plan and follow-up protocol; reconciliation of information (medication and follow-up needs); streamlining medication regimens; face-to-face meetings with patient's physician (in hospital; at follow-up); expertise in management of heart failure fostering collaborative relationships; transmitting summaries of goal progression, unresolved issues, and recommendations to community physician
Wells et al, 2004 (52)	Nurse-led early discharge	Preoperative liaison with primary care (in particular, CNs) to negotiate postoperative involvement; discharge summary faxed to community care providers; patient-held records and care protocols shared with community care providers; 24-h access to breast care nurse via mobile telephone
Lim et al, 2003 (53)	Case management and post-acute care program	Creation of discharge plan; organizing postdischarge services/follow-up; time and expertise; liaison with community service providers
Avlund et al, 2002 (54)	Comprehensive follow-up home visits	Home visits of geriatric hospital team member together with home care nurse to assess needs and organize follow-up; negotiated postoperative involvement with community care providers; reporting and discussing medical problems with GP
Harrison et al, 2002 (55)	Hospital-to-home transitional care model	Use of protocol to enhance links between hospital and home care; nurse transfer letter transmitted to home care nurse; telephone outreach to home care to notify primary contact person in hospital
Indredavik et al, 2000 (56)	Extended stroke service unit with early supported discharge	Predischarge evaluation of patient needs; primary care informed before discharge; case conference with primary care providers (face-to-face); creation of plan for follow-up (checked at dedicated discharge meeting); allocation of tasks and responsibilities; transmitting follow-up plan and patient information to community physician, nurse, and therapists
Nazareth et al, 2001 (57)	Pharmacy discharge plan	Creation of integrated discharge plan; transmitting discharge plan to community pharmacist and physician; liaison with community pharmacist and physician; reconciliation of information (medication)
Rutherford and Burge, 2001 (58)	Personal invitation to GPs to visit or contact hospital and a special discharge summary	Invitation by telephone for GPs to visit the hospital at patient admission or to telephone hospital staff (to assist with planning); special discharge summary (presented in a distinctive red binder)
McInnes et al, 1999 (59)	GP input into discharge planning	Invitations to GPs by the geriatrician to make a predischarge visit; request to the GP to provide written information specific to the individual patient via a consultation sheet (e.g., follow-up recommendations); the GP was able to talk to hospital staff and see the patient and had access to medical notes
Naylor et al, 1999 (60)	APN-centered comprehensive discharge planning and home follow-up protocol	Creation and implementation of discharge plan; physicians write discharge orders within 24 h; collaboration with physicians to make adjustments in therapies and obtain referrals for needed services; transmitting discharge summaries to community physician and other providers detailing the plans, goal progression, and ongoing concerns
van Walraven et al, 1999 (61)	Database-generated discharge summaries	Discharge information grouped and structured by 3 separate, standard forms; discharge forms were completed during hospitalization and entered into a computer database after discharge; use of reminders (stickers) when forms were blank; discharge summaries were generated from database
Siu et al, 1996 (62)	Postdischarge geriatric assessment	Reconciliation of information (medical records); home visit to assess needs and organize follow-up; case conference by interdisciplinary team; transmitting recommendations or requests for follow-up to community physician; providing community physician with annotated literature references and personal contact to enhance community physician's adherence to recommendations; precompleted forms (needing only indication of approval) to facilitate the execution of recommendations when community physician's approval was needed
Rich et al, 1993 (63)	Comprehensive multidisciplinary treatment strategy	Reconciliation of information (medication); patient visit and follow-up planning by home care representative and social worker during hospitalization; discharge summary completed at discharge and transmitted to home care

APN = advanced practice nurse; CLP = community liaison pharmacist; CN = community nurse; ED = emergency department; EMR = electronic medical record; GP = general practitioner; MDP = medication discharge plan; PML = preadmission medication list.

* Two separate studies using the same intervention, setting, and population but different outcome measures.

related to the improvement of continuity of care after discharge (for example, timeliness and accuracy of discharge information received by or accessible to the GP), and improvement of patient status (for example, quality of life and satisfaction). There is no strong evidence that a single intervention is regularly associated with positive effects on a specific outcome measure. Most multicomponent discharge interventions that seem to have positive effects on various outcome measures are reported in various ways.

Nevertheless, in some studies, we found statistically significant effects in favor of the intervention group for outcome measures that strongly relate to the purpose of a specific component of the intervention studied (for example, medication reconciliation reducing the percentage of unreconciled medication after discharge).

Our study has limitations. First, despite the relatively high overall methodological quality rating of the included literature, the objectivity and reliability of the data are

Table 3—Continued

Key Players	Setting	Classification of Intervention		
		Information	Coordination	Communication
APNs	During hospitalization; at discharge; after discharge	✓	✓	✓
Liaison breast care nurse	During hospitalization; at discharge; after discharge		✓	✓
Post-acute care coordinators (hospital-based staff with allied health or nursing backgrounds)	After discharge		✓	✓
Geriatric team, home care nurse/helper, physiotherapist, occupational therapist	At discharge; after discharge		✓	✓
Hospital and home care nurses	During hospitalization; at discharge; after discharge		✓	✓
Mobile (multidisciplinary) stroke team	During hospitalization; at discharge; after discharge	✓	✓	✓
Hospital and community pharmacists	Unknown; after discharge	✓	✓	✓
GP researchers, research nurses	During hospitalization, after discharge	✓	✓	✓
GPs, geriatricians	During hospitalization		✓	✓
APNs	During hospitalization; after discharge		✓	✓
Second- or third-year internal medicine resident, interns, and medical students (housestaff)	During hospitalization; after discharge	✓		✓
Nurse practitioner, interdisciplinary team	During hospitalization; after discharge	✓	✓	✓
Geriatric cardiac nurse, geriatric cardiologist, dietitian, social services, home care	During hospitalization; at discharge; unknown	✓	✓	✓

questionable because only 6 RCTs studied an intervention group with more than 300 participants, and 22 studies (61.1%) either had assessors who were not blinded to the outcomes or had unknown blinding status. Second, many of the studies that we reviewed had diffuse aims and lacked sufficient and clear descriptions of the interventions. Third, many interventions consisted of a complex set of activities or tools that sought to improve the handover between hospital and primary care providers as well as handovers between care providers and patients or their relatives (for example, discharge instructions, education, or home visits). Fourth, like other reviews of patient handovers (21,

23), our review deals with complex interventions, including the number of interactions between components, the number and difficulty of behaviors required by those delivering or receiving the interventions, the number of groups or organizational levels targeted by the interventions, the number and variability of outcomes, and the permitted degree of flexibility or tailoring of the intervention (64). Also, most studies contain specific components that have not been studied outside of their multicomponent bundle (14). These aspects hinder an appropriate and direct evaluation of the interventions. Fifth, we found great variability in control conditions, patient populations, out-

come definition, methods of outcome measurement, and outcome assessment times and a high degree of clinical diversity, which makes synthesizing results and drawing conclusions difficult. Sixth, many studies used outcomes that are not considered suitable for measuring the effectiveness of patient handovers between hospital and primary care providers at discharge (for example, outcomes related to patient status). There is a possibility that interventions have an effect but that the measurements of their outcomes are unreliable or are not sensitive enough to be measured (65, 66). Seventh, our review may have been influenced by publication bias; unpublished studies on this subject may be more likely to have negative results. Finally, our search strategy was limited to English-language studies and did not include unpublished abstracts from conference proceedings or nonindexed journals.

We believe that promising interventions for improving patient handovers exist but require further investigation. For example, medication reconciliation, creation of a discharge plan, and use of electronic discharge notifications and Web-based access to discharge information for GPs were included in 11, 7, and 2 reviewed RCTs, respectively, that showed statistically significant effects. The evidence suggests that the recommendations for practice must be tempered by the sparse evidence and the limitations described earlier. The strong methodological quality of these studies supports the reliability of the findings of this review. The need for these types of interventions is supported by various studies showing medication discrepancies, ineffective planning, and delayed or absent patient information to primary care providers as major deficits in the discharge process (6). These deficits increase the chance of lower quality of care and adverse clinical outcomes (6, 8, 67). We also believe, on the basis of the findings of these studies and those of our review, that more attention should be directed to developing standardized measures of continuity of care (for example, timeliness and accuracy of discharge information) for a better evaluation of, and comparison between, discharge interventions.

Although professional attitudes and aspects of organizational culture are increasingly considered to be important factors in influencing the quality and safety of handovers (68, 69), surprisingly, only 3 of the studies described the intended actions with the aim to influence the attitudes of care providers (51, 58, 62). Also, we found no studies that described education or training on how to conduct effective handovers as an intervention itself, which is all the more surprising given current literature suggesting that the lack of formal handover training or education is an important cause for poor communication and coordination among providers at handovers within the hospital (19) and the hospital–primary care interface (11, 68, 70, 71). This is especially important with the increase in handovers done by junior physicians and nurses, who often are neither prepared nor supervised (11, 19).

In conclusion, many interventions aimed at improving the discharge quality and safety of handovers between hospital and primary care providers have a positive effect on improving patient care. They are increasingly embraced as best practices by hospitals in such existing and promising initiatives as BOOST (Better Outcomes for Older adults through Safe Transitions) (72) and STAAR (State Action on Avoidable Rehospitalizations) (73). However, our review shows that the description of the intervention's aim and components, the heterogeneity of the interventions and study characteristics, and the validity of the outcome measurements hinder the demonstration of robust evidence to support the interventions. The mechanisms underlying these interventions that improve the quality and safety of handovers between hospital and primary care providers at discharge is still unknown. Our review also outlines a rich area for several key research questions, including developing a clearer description of the interventions, using uniform and valid outcome measures, and attending to the care provider's attitudes and training in developing effective handover interventions.

From Radboud University Nijmegen Medical Centre, Nijmegen, and University Medical Center Utrecht, Utrecht, the Netherlands.

Acknowledgment: The authors thank Reinier Akkermans, MSc, for methodological and statistical assistance.

Grant Support: By the European Union, the Framework Programme of the European Commission (FP7-HEALTH-F2-2008-223409).

Potential Conflicts of Interest: Mr. Hesselink: *Grant (money to institution):* European Union, the Framework Programme of the European Health Commission; *Support for travel to meetings for the study or other purposes:* European Union, the Framework Programme of the European Health Commission. Dr. Schoonhoven: *Grant (money to institution):* European Union, the Framework Programme of the European Health Commission. Dr. Barach: *Grant (money to institution):* European Union, the Framework Programme of the European Health Commission; *Support for travel to meetings for the study or other purposes:* European Union, the Framework Programme of the European Health Commission. Dr. Gademan: *Grant (money to institution):* European Union, the Framework Programme of the European Health Commission. Dr. Kalkman: *Grant (money to institution):* European Union; *Support for travel to meetings for the study or other purposes:* European Union. Dr. Vernooij-Dassen: *Grant (money to institution):* European Union; *Support for travel to meetings for the study or other purposes:* European Union; *Employment:* Radboud University Nijmegen; *Grants/grants pending (money to institution):* European Union. Dr. Wollersheim: *Grant (money to institution):* European Union, the Framework Programme of the European Health Commission; *Support for travel to meetings for the study or other purposes:* European Union, the Framework Programme of the European Health Commission. Disclosures can also be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M11-2696.

Requests for Single Reprints: Gijs Hesselink, MA, MSc, Scientific Institute for Quality of Healthcare (IQ Healthcare), Radboud University Nijmegen Medical Centre, PO Box 9101, IQ 114, 6500 HB Nijmegen, the Netherlands; e-mail, g.hesselink@iq.umcn.nl.

Current author addresses and author contributions are available at www.annals.org.

References

- 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]
- McKenna H, Keeney S, Glenn A, Gordon P. Discharge planning: an exploratory study. *J Clin Nurs*. 2000;9:594-601. [PMID: 11261142]
- Hellesø R, Lorensen M, Sorensen L. Challenging the information gap—the patients transfer from hospital to home health care. *Int J Med Inform*. 2004;73:569-80. [PMID: 15246037]
- Atwal A. Nurses' perceptions of discharge planning in acute health care: a case study in one British teaching hospital. *J Adv Nurs*. 2002;39:450-8. [PMID: 12175354]
- Boockvar K, Fishman E, Kyriacou CK, Monias A, Gavi S, Cortes T. Adverse events due to discontinuations in drug use and dose changes in patients transferred between acute and long-term care facilities. *Arch Intern Med*. 2004;164:545-50. [PMID: 15006832]
- 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]
- 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]
- Moore C, Wisnivesky J, Williams S, McGinn T. Medical errors related to discontinuity of care from an inpatient to an outpatient setting. *J Gen Intern Med*. 2003;18:646-51. [PMID: 12911647]
- Murtaugh CM, Litke A. Transitions through postacute and long-term care settings: patterns of use and outcomes for a national cohort of elders. *Med Care*. 2002;40:227-36. [PMID: 11880795]
- Clare J, Hofmeyer A. Discharge planning and continuity of care for aged people: indicators of satisfaction and implications for practice. *Aust J Adv Nurs*. 1998;16:7-13. [PMID: 9807277]
- McKeown F. The experiences of older people on discharge from hospital following assessment by the public health nurse. *J Clin Nurs*. 2007;16:469-76. [PMID: 17335522]
- Mistiaen P, Duijnhouwer E, Wijk D, de Bont M, Veeger A. The problems of elderly people at home one week after discharge from an acute care setting. *J Adv Nurs*. 1997;25:1233-40. [PMID: 9181422]
- Coleman EA. Falling through the cracks: challenges and opportunities for improving transitional care for persons with continuous complex care needs. *J Am Geriatr Soc*. 2003;51:549-55. [PMID: 12657078]
- 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]
- 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]
- Shepperd S, Parkes J, McClaren J, Phillips C. Discharge planning from hospital to home. *Cochrane Database Syst Rev*. 2004;CD000313. [PMID: 14973952]
- Raduma-Tomás MA, Flin R, Yule S, Williams D. Doctors' handovers in hospitals: a literature review. *BMJ Qual Saf*. 2011;20:128-33. [PMID: 21209133]
- Arora VM, Manjarrez E, Dressler DD, Basaviah P, Halasyamani L, Kripalani S. Hospitalist handoffs: a systematic review and task force recommendations. *J Hosp Med*. 2009;4:433-40. [PMID: 19753573]
- 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]
- Akbari A, Mayhew A, Al-Alawi MA, Grimshaw J, Winkens R, Glidewell E, et al. Interventions to improve outpatient referrals from primary care to secondary care. *Cochrane Database Syst Rev*. 2008;CD005471. [PMID: 18843691]
- 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]
- Mistiaen P, Poot E. Telephone follow-up, initiated by a hospital-based health professional, for postdischarge problems in patients discharged from hospital to home. *Cochrane Database Syst Rev*. 2006;CD004510. [PMID: 17054207]
- 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]
- Higgins J, Green S. *Cochrane Handbook for Systematic Reviews of Interventions*. Chichester, United Kingdom: J Wiley; 2006.
- Grimshaw J, McAuley LM, Bero LA, Grilli R, Oxman AD, Ramsay C, et al. Systematic reviews of the effectiveness of quality improvement strategies and programmes. *Qual Saf Health Care*. 2003;12:298-303. [PMID: 12897365]
- Naylor M, Broton D, Jones R, Lavizzo-Mourey R, Mezey M, Pauly M. Comprehensive discharge planning for the hospitalized elderly. A randomized clinical trial. *Ann Intern Med*. 1994;120:999-1006. [PMID: 8185149]
- Lin PC, Wang CH, Chen CS, Liao LP, Kao SF, Wu HF. To evaluate the effectiveness of a discharge-planning programme for hip fracture patients. *J Clin Nurs*. 2009;18:1632-9. [PMID: 19490299]
- Arbaje AI, Maron DD, Yu Q, Wendel VI, Tanner E, Boulc C, et al. The geriatric floating interdisciplinary transition team. *J Am Geriatr Soc*. 2010;58:364-70. [PMID: 20370860]
- Chen Y, Brennan N, Magrabi F. Is email an effective method for hospital discharge communication? A randomized controlled trial to examine delivery of computer-generated discharge summaries by email, fax, post and patient hand delivery. *Int J Med Inform*. 2010;79:167-72. [PMID: 20097600]
- Egink RN, Lenderink AW, Widdershoven JW, van den Bemt PM. The effect of a clinical pharmacist discharge service on medication discrepancies in patients with heart failure. *Pharm World Sci*. 2010;32:759-66. [PMID: 20809276]
- Rytter L, Jakobsen HN, Rønholt F, Hammer AV, Andreassen AH, Nissen A, et al. Comprehensive discharge follow-up in patients' homes by GPs and district nurses of elderly patients. A randomized controlled trial. *Scand J Prim Health Care*. 2010;28:146-53. [PMID: 20429738]
- Shyu YI, Liang J, Wu CC, Su JY, Cheng HS, Chou SW, et al. Two-year effects of interdisciplinary intervention for hip fracture in older Taiwanese. *J Am Geriatr Soc*. 2010;58:1081-9. [PMID: 20722845]
- Graumlich JF, Novotny NL, Nace GS, Aldag JC. Patient and physician perceptions after software-assisted hospital discharge: cluster randomized trial. *J Hosp Med*. 2009;4:356-63. [PMID: 19621342]
- 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]
- 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]
- 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]
- Maslove DM, Leiter RE, Griesman J, Arnott C, Mourad O, Chow CM, et al. Electronic versus dictated hospital discharge summaries: a randomized controlled trial. *J Gen Intern Med*. 2009;24:995-1001. [PMID: 19609623]
- 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]
- Tripp JS. Development and Evaluation of Notifications to Inform Primary Care Providers of Summary Documentation for Their Patients' Hospital Visits [Dissertation]. Salt Lake City, UT: Univ of Utah; 2009.
- King TL. The Impact of a Nurse-Driven Evidence-Based Discharge Planning Protocol on Organizational Efficiency and Patient Satisfaction in Patients with Cardiac Implants [Dissertation]. Orlando, FL: Univ of Central Florida; 2008.
- Lalonde L, Lampron AM, Vanier MC, Levasseur P, Khaddag R, Chaar N. Effectiveness of a medication discharge plan for transitions of care from hospital to outpatient settings. *Am J Health Syst Pharm*. 2008;65:1451-7. [PMID: 18653816]
- Mayo NE, Nadeau L, Ahmed S, White C, Grad R, Huang A, et al. Bridging the gap: the effectiveness of teaming a stroke coordinator with patient's personal physician on the outcome of stroke. *Age Ageing*. 2008;37:32-8. [PMID: 18006510]

43. **Vuong T, Marriott JL, Kong DCM, Siderov J.** Implementation of a community liaison pharmacy service: a randomised controlled trial. *Int J Pharm Pract.* 2008;16:127-35.
44. **Afilalo M, Lang E, Léger R, Xue X, Colacone A, Soucy N, et al.** Impact of a standardized communication system on continuity of care between family physicians and the emergency department. *CJEM.* 2007;9:79-86. [PMID: 17391577]
45. **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]
46. **Preen DB, Bailey BE, Wright A, Kendall P, Phillips M, Hung J, et al.** Effects of a multidisciplinary, post-discharge continuance of care intervention on quality of life, discharge satisfaction, and hospital length of stay: a randomized controlled trial. *Int J Qual Health Care.* 2005;17:43-51. [PMID: 15668310]
47. **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]
48. **Caplan GA, Williams AJ, Daly B, Abraham K.** A randomized, controlled trial of comprehensive geriatric assessment and multidisciplinary intervention after discharge of elderly from the emergency department—the DEED II study. *J Am Geriatr Soc.* 2004;52:1417-23. [PMID: 15341540]
49. **Crotty M, Rowett D, Spurling L, Giles LC, Phillips PA.** Does the addition of a pharmacist transition coordinator improve evidence-based medication management and health outcomes in older adults moving from the hospital to a long-term care facility? Results of a randomized, controlled trial. *Am J Geriatr Pharmacother.* 2004;2:257-64. [PMID: 15903284]
50. **Kwok T, Lum CM, Chan HS, Ma HM, Lee D, Woo J.** A randomized, controlled trial of an intensive community nurse-supported discharge program in preventing hospital readmissions of older patients with chronic lung disease. *J Am Geriatr Soc.* 2004;52:1240-6. [PMID: 15271109]
51. **Naylor MD, Brooten DA, Campbell RL, Maislin G, McCauley KM, Schwartz JS.** Transitional care of older adults hospitalized with heart failure: a randomized, controlled trial. *J Am Geriatr Soc.* 2004;52:675-84. [PMID: 15086645]
52. **Wells M, Harrow A, Donnan P, Davey P, Devereux S, Little G, et al.** Patient, carer and health service outcomes of nurse-led early discharge after breast cancer surgery: a randomised controlled trial. *Br J Cancer.* 2004;91:651-8. [PMID: 15238983]
53. **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]
54. **Avlund K, Jepsen E, Vass M, Lundemark H.** Effects of comprehensive follow-up home visits after hospitalization on functional ability and readmissions among old patients. A randomized controlled study. *Scand J Occup Ther.* 2002;9:17-22.
55. **Harrison MB, Browne GB, Roberts J, Tugwell P, Gafni A, Graham ID.** Quality of life of individuals with heart failure: a randomized trial of the effectiveness of two models of hospital-to-home transition. *Med Care.* 2002;40:271-82. [PMID: 12021683]
56. **Indredavik B, Fjaertoft H, Ekeberg G, Løge AD, Mørch B.** Benefit of an extended stroke unit service with early supported discharge: a randomized, controlled trial. *Stroke.* 2000;31:2989-94. [PMID: 11108761]
57. **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]
58. **Rutherford A, Burge B.** General practitioners and hospitals. Continuity of care. *Aust Fam Physician.* 2001;30:1101-7. [PMID: 11759464]
59. **McInnes E, Mira M, Atkin N, Kennedy P, Cullen J.** Can GP input into discharge planning result in better outcomes for the frail aged: results from a randomized controlled trial. *Fam Pract.* 1999;16:289-93. [PMID: 10439984]
60. **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]
61. **van Walraven C, Laupacis A, Seth R, Wells G.** Dictated versus database-generated discharge summaries: a randomized clinical trial. *CMAJ.* 1999;160:319-26. [PMID: 10065073]
62. **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]
63. **Rich MW, Vinson JM, Sperry JC, Shah AS, Spinner LR, Chung MK, et al.** Prevention of readmission in elderly patients with congestive heart failure: results of a prospective, randomized pilot study. *J Gen Intern Med.* 1993;8:585-90. [PMID: 8289096]
64. **Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M; Medical Research Council Guidance.** Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ.* 2008;337:a1655. [PMID: 18824488]
65. **Mistiaen P.** Hospital Discharge: Problems and Interventions [PhD thesis]. Utrecht, the Netherlands: Netherlands Inst for Health Services Research; 2007.
66. **Lilford R, Pronovost P.** Using hospital mortality rates to judge hospital performance: a bad idea that just won't go away. *BMJ.* 2010;340:c2016. [PMID: 20406861]
67. **van Walraven C, Seth R, Austin PC, Laupacis A.** Effect of discharge summary availability during post-discharge visits on hospital readmission. *J Gen Intern Med.* 2002;17:186-92. [PMID: 11929504]
68. **Connolly M, Grimshaw J, Dodd M, Cawthorne J, Hulme T, Everitt S, et al.** Systems and people under pressure: the discharge process in an acute hospital. *J Clin Nurs.* 2009;18:549-58. [PMID: 19192004]
69. **Hellesø R, Fagermoen MS.** Cultural diversity between hospital and community nurses: implications for continuity of care. *Int J Integr Care.* 2010;10:e036. [PMID: 20422021]
70. **Brand SL.** Nurses' roles in discharge decision making in an adult high dependency unit. *Intensive Crit Care Nurs.* 2006;22:106-14. [PMID: 16198571]
71. **Johnson JK, Arora VM.** Improving clinical handovers: creating local solutions for a global problem. *Qual Saf Health Care.* 2009;18:244-5. [PMID: 19651924]
72. **Society of Hospital Medicine.** BOOSTing Care Transitions Resource Room. Philadelphia: Soc of Hospital Medicine; 2008. Accessed at www.hospitalmedicine.org/ResourceRoomRedesign/RR_CareTransitions/CT_Home.cfm on 1 January 2012.
73. **Institute for Healthcare Improvement.** State Action on Avoidable Rehospitalizations (STAAR) Initiative. Cambridge, MA: Inst for Healthcare Improvement; 2012. Accessed at www.ihc.org/staar on 1 January 2012.

Current Author Addresses: Mr. Hesselink; Ms. Spijker and Ms. Liefers; and Drs. Schoonhoven, Vernooij-Dassen, and Wollersheim: Scientific Institute for Quality of Healthcare (IQ Healthcare), Radboud University Nijmegen Medical Centre, PO Box 9101, IQ 114, 6500 HB Nijmegen, the Netherlands.

Drs. Barach, Gademan, and Kalkman: UMC Utrecht, PO Box 85500, 3508 GA Utrecht, the Netherlands.

Author Contributions: Conception and design: G. Hesselink, L. Schoonhoven, P. Barach, A. Spijker, P. Gademan, M. Vernooij-Dassen, H. Wollersheim.

Analysis and interpretation of the data: G. Hesselink, L. Schoonhoven, P. Gademan, J. Liefers, M. Vernooij-Dassen, H. Wollersheim.

Drafting of the article: G. Hesselink, L. Schoonhoven, P. Barach, M. Vernooij-Dassen, H. Wollersheim.

Critical revision of the article for important intellectual content: L. Schoonhoven, P. Barach, A. Spijker, C. Kalkman, M. Vernooij-Dassen, H. Wollersheim.

Final approval of the article: G. Hesselink, L. Schoonhoven, P. Barach, A. Spijker, P. Gademan, C. Kalkman, J. Liefers, M. Vernooij-Dassen, H. Wollersheim.

Statistical expertise: M. Vernooij-Dassen.

Obtaining of funding: P. Barach, H. Wollersheim.

Administrative, technical, or logistic support: J. Liefers, H. Wollersheim.

Collection and assembly of data: G. Hesselink, A. Spijker, P. Gademan, J. Liefers, H. Wollersheim.

Appendix Table 1. Search Strings, by Database

PubMed (1990–2011)

Search Strategy

(((((hospital discharg*[tiab]) OR (((patient discharge[Mesh])) AND ((hospital[tiab] OR hospitals[tiab] OR home[tiab])))) OR (((patient[tiab] OR patients[tiab] OR client*[tiab] OR subject*[tiab])) AND ((discharg*[tiab] OR transfer*[tiab] OR transition*[tiab] OR "aftercare"[Mesh])) AND ((hospital[tiab] OR hospitals[tiab] OR home[tiab])))) AND ("Home-care services" OR "Discharge plan" OR "Discharge summary" OR "Community health nursing" OR "Discharge planning" OR telemedicine OR (postdischarge AND support) OR (Home AND (intervention OR rehabilitation) AND (program OR programme OR programs OR programmes)) OR (nurse[tw] AND consultant) OR (medication instruction) OR (discharge AND education) OR (telephone follow up) OR (discharge AND service) OR "Liaison nurse" OR "hospital discharge preparation" OR "discharge rounds" OR telemedicine OR "intermediate care units" OR (posthospital AND support) OR (discharge AND coordinator*)))) AND ((Randomized controlled trial[PT]))

Hits: 870

CINAHL (1990–2011)

Search Strategy

(PT clinical trial or (TI Randomi?ed control\$ trial\$ or AB Randomi?ed control\$ trial\$) or (random assignment) or ((TI control* or AB control*) and (TI random* or AB random*) and (TI trial* or AB trial*)) or (TI random* or AB random*) and (TI trial* or AB trial*) and (TI clinical* or AB clinical*)) And (MH home visits or MH discharge planning or MH telemedicine or MH community health nursing or MH patient discharge education or MH after care) And (((TI hospital discharg* or AB hospital discharg*) or ((MW patient discharge or AB patient discharg*) and (TI hospital or AB hospital or TI hospitals or AB hospitals or TI home or AB home or AB "hospital to community" or MW hospitals or MW hospital))) or ((TI discharg* or AB discharg*) or (TI transfer* or AB transfer*) or (TI transition* or AB transition*) or (AB aftercare)) and ((TI home or AB home or AB "hospital to community" or MW hospital or MW hospitals or TI hospital or AB hospital or TI hospitals or AB hospitals)) and ((TI patient or AB patient or TI patients or AB patients or TI client* or AB client* or AB consumer* or AB recipient*) or AB subject*))

Hits: 115

PsycInfo (1990–2011)

Search Strategy

((hospital.ti. or hospital.ab. or hospital.hw. or hospitals.ti. or hospitals.ab. or home.ti. or home.ab. or patient.ti. or patient.ab. or patients.ti. or patients.ab. or client*.ti. or client*.ab. or client*.hw. or consumer*.ti. or consumer*.ab. or recipient*.ti. or recipient*.ab. or subject*.ti. or subject*.ab. or discharg*.ti. or discharg*.ab. or transfer*.ti. or transfer*.ab. or transition*.ti. or transition*.ab. or aftercare/ or aftercare.ti. or aftercare.ab.) or ((hospital discharg.sh. or (hospital adj discharg*).ti. or (hospital adj discharg*).ab. or (hospital.ti. or hospital.ab. or hospital.hw. or hospitals.ti. or hospitals.ab. or home.ti. or home.ab.) and (patient adj discharges.ab.))) and ((random:.ti. or random:.ab. or ((singl: or doubl: or trebl: or tripl:) adj5 blind).ti. or ((singl: or doubl: or trebl: or tripl:) adj5 blind).ab. or ((singl: or doubl: or trebl: or tripl:) adj5 blind).tc. or ((singl: or doubl: or trebl: or tripl:) adj5 blind).id.) or experimental design.sh. or clinical trial.id. or ((clin: adj25 trial:).ti. or (clin: adj25 trial:).ab.) or clinical trial:.ti. or clinical trial:.ab. or clinical trial:.tc. or clinical trial:.id. or experimentation.sh. or placebo:.ti. or placebo:.ab. or placebo:.tc. or placebo:.id. or methodology.sh. (or treatment effectiveness evaluation.sh. or double blind.ti. or double blind.ab. or double blind.tc. or double blind.id. or (random: and allocat:).ti. or (random: and allocat:).ab. or (random: and allocat:).tc. or (random: and allocat:).id. or (random: and trial:).ti. or (random: and trial:).ab. or (random: and trial:).tc. or (random: and trial:).id. or single blind.ti. or single blind.ab. or single blind.tc. or single blind.id.) and(exp "Continuum of Care"/ or exp Telemedicine/ or exp Health Care Services/ or exp Home Care/ or exp Discharge Planning/ or exp Home Care Personnel/ or exp Home Visiting Programs/)

Hits: 177

Cochrane Library (1990–2011)

Search Strategy

(hospital discharge or patient discharge):ti,ab,kw and (hospital or hospitals or home or patient or patients or client or subject):ti,ab,kw and (Discharge or transfer or transition or aftercare):ti,ab,kw and (Home-care services or Discharge plan or Discharge summary or Community health nursing or Discharge planning or telemedicine or support or intervention or rehabilitation or program or programme or programs or programmes or nurse or consultant or medication or instruction or education or telephone or service or liaison or preparation or discharge rounds or telemedicine or intermediate care units or coordinator):ti,ab,kw and (randomized controlled trial):ti,ab,kw, from 1990 to 2012 in Clinical Trials

Hits: 1371

EMBASE (1990–2011)

Search Strategy

- 1 (hospital discharge or patient discharge).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword] (55871)
- 2 (hospital or hospitals or home or patient or patients or client or subject).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword] (5756986)
- 3 (Discharge or transfer or transition or aftercare).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword] (660677)
- 4 (Hospital or hospitals or home).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword] (1215905)
- 5 (Home-care services or Discharge plan or Discharge summary or Community health nursing or Discharge planning or telemedicine or support or intervention or rehabilitation or program or programme or programs or programmes or nurse or consultant or medication or instruction or education or telephone or service or liaison or preparation or discharge rounds or telemedicine or intermediate care units or coordinator).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword] (2914640)
- 6 randomized controlled trial/ (296357)
- 7 1 and 2 and 3 and 4 and 5 and 6 (1276)
- 8 7 and "Journal: Article".sa_pubt. (1107)
- 9 8 and 1990:2012.(sa_year). (1096)
- 10 9 and "controlled study".sa_suba. (1041)
- 11 10 and "controlled study".sa_suba. (1041)
- 12 7 and 11 (1041)

Hits: 1041

Appendix Table 2. Characteristics and Findings of Included Studies

Study, Year (Reference)	Setting (Country)	Participants, n		Intervention vs. Control (Classification*)	Results		P Value	
		Intervention Group	Control Group		Outcomes†	Intervention Group		Control Group
Arbaje et al, 2010 (28)	Elderly patients admitted to 4 general medicine teaching services at an academic medical center (United States)	366	351	Geriatric floating interdisciplinary transition team vs. usual care (2, 3)	GP knowledge of patient's experiences in the hospital by 14 d, % Length of hospital stay by 14 d, %	76.7 72.3	72.2 66.4	0.160 0.42
Chen et al, 2010 (29)	Geriatric patients admitted to the acute aged care ward of a metropolitan teaching hospital (Australia)	40 (e-mail)	48 (fax), 40 (mail), 40 (patient)	Delivery of computer-based discharge summaries from hospital to GP by e-mail vs. by fax, mail, or patient hand delivery (3)	Discharge summaries received by GP by 1 wk, %	73.9 (e-mail)	69.4 (fax); 43.8 (mail); 24.2 (patient)	<0.001‡
Eggink et al, 2010 (30)	Patients admitted to the department of cardiology of a teaching hospital (the Netherlands)	41	44	Clinical pharmacist discharge service vs. usual care	At least 1 discrepancy or prescription error within 6 wk, % Medications with a discrepancy or prescription error within 6 wk, %	39 6.1	68 14.6	NR NR
Rytter et al, 2010 (31)	Elderly patients discharged from the geriatric or internal medical ward at a large teaching hospital (Denmark)	166	165	Comprehensive discharge follow-up in patients' homes by GPs and district nurses vs. usual discharge care (2)	Medication adherence§ Patient medication that GP did not know about by 12 wk, % GP reporting medication that patients did not receive by 12 wk, % Planned clinical control completed as recommended by 12 wk, % Planned paraclinical control completed as recommended by 12 wk, % GP very well-informed about patient hospitalization by 12 wk, %	78.0 34 28 95 88 42	79.5 48 39 72 68 16	NR 0.020 0.050 0.020 0.090 0.010
Shyu et al, 2010 (32)	Elderly patients hospitalized for accidental single-side hip fracture receiving hip arthroplasty or internal fixation (Taiwan)	80	82	Interdisciplinary intervention program vs. usual discharge care (2)	Improvement of quality of life (SF-36) by 3 mo, PCS score Improvement of quality of life (SF-36) by 3 mo, MCS score Death by 3 mo Service use by 3 mo	NR NR NR NR	NR NR NR NR	<0.001 NS NS NS
Graumlich et al, 2009 (33)	Hospital physicians and their patients admitted to a tertiary care, teaching hospital (United States)	35 (hospital physicians), 316 (patients)	35 (hospital physicians), 315 (patients)	Software-assisted hospital discharge vs. usual care, handwritten discharge (1, 2, 3)	Mean patient perception of discharge preparedness (B-PREPARED scale) by 1 wk (SD) Mean patient satisfaction with medication information (SIMS) by 1 wk (SD) Mean outpatient physician perception of timeliness of communication and adequacy of discharge plan (Modified Physician-PREPARED scale) by 19 d (SD) Adverse event within 1 mo, %	17.7 (4.1) 12.3 (4.8) 17.2 (3.8)	17.2 (4.0) 12.1 (4.6) 16.5 (3.9)	0.040 0.57 0.030
Graumlich et al, 2009 (34)	Hospital physicians and their patients admitted to a tertiary care, teaching hospital (United States)	35 (hospital physicians), 316 (patients)	35 (hospital physicians), 315 (patients)	Software-assisted hospital discharge vs. usual care, handwritten discharge (1, 2, 3)	Hospital visits per person within 1 mo Follow-up visits by GP within 1 mo, % ED visits per person within 1 mo Rehospitalizations per person within 1 mo Patients able to identify discharge diagnosis (indicated by interview) by 1 mo, % Patients able to identify GP name (indicated by interview) by 1 mo, %	0.3 44 0.2 0.1 79	0.5 62 0.2 0.2 70	0.009 0.001 0.014 0.090 0.017
Jack et al, 2009 (35)	Patients admitted to a general medical service at an urban, academic, safety net hospital (United States)	370	368	Reengineered hospital discharge program vs. usual discharge planning (1, 2, 3)		7.3	7.3	0.88
Koehler et al, 2009 (36)	Elderly patients admitted to a hospital medicine unit at a university medical center (United States)	20	21	Supplemental care bundle vs. usual care (1, 2, 3)	Postdischarge rehospitalizations/ED visits (0 to 30 d), % Postdischarge rehospitalizations/ED visits (31 to 60 d), %	10 20	38 5	0.030 0.180

Continued on following page

Appendix Table 2—Continued

Study, Year (Reference)	Setting (Country)	Participants, n		Intervention vs. Control (Classification*)	Results			
		Intervention Group	Control Group		Outcomes	Intervention Group	Control Group	P Value
Maslove et al, 2009 (37)	Patients discharged from a general internal medicine service at a tertiary care, teaching, university-affiliated hospital (Canada)	105	104	Electronic discharge summary program vs. conventional dictated discharge summaries (1, 3)	Mean quality of discharge summary by 2 wk (SD) Mean completeness of discharge summary by 2 wk (SD) Mean discharge summary organization by 2 wk (SD) Mean timeliness (time from patient discharge to summary receipt) by 2 wk (SD) Mean house staff satisfaction with method of summary generation by 3 mo Adverse outcomes within 30 d, %	86.4 (15.0) 88.2 (12.4) 88.3 (9.8) 88.4 (15.8) 75.7 21	84.3 (17.6) 83.5 (19.1) 85.5 (17.6) 82.9 (21.2) 44.5 20	0.53 0.160 0.34 0.160 0.10 0.89
Schipper et al, 2009 (38)	Patients admitted to general medical inpatient units at 2 academic hospitals (United States)	162	160	Computerized medication reconciliation tool and process redesign involving physicians, nurses, and pharmacists	Potential adverse drug events (per patient) due to unintentional medication discrepancies between prehospitalization medications and hospitalization or discharge medications, n	170 (1.05)	230 (1.44)	NR
Tripp, 2009 (39)	Patients admitted to inpatient care or ED at 3 hospitals (United States)	397 (inpatient), 1098 (ED)	396 (inpatient), 1107 (ED)	Notification to GPs of discharge summary being stored in patient's electronic medical record vs. no notification (3)	Documentation accessed by GP, % Time from creation to GP's first access of documentation, d Documentation accessed before first follow-up appointment with patient or in first 24 h, % Time from discharge to scheduling of first follow-up appointment, d Rehospitalization by 30 d, % Rehospitalization by 60 d, % ED use by 30 d, % ED use by 60 d, %	79.9 (inpatient); 6.6 (inpatient); 6.8 (ED) 81.7 (inpatient); 85.8 (ED) 12.5 (inpatient); 14.1 (ED) 7.3 (inpatient); 4.5 (ED) 11.1 (inpatient); 6.3 (ED) 5.8 (inpatient); 12.6 (ED) 9.1 (inpatient); 17.3 (ED)	64.7 (inpatient); 12.2 (inpatient and ED); 68.3 (inpatient); 78.4 (ED) 9.5 (inpatient); 15.4 (ED) 6.1 (inpatient); 4.5 (ED) 9.6 (inpatient); 6.4 (ED) 5.1 (inpatient); 12.7 (ED) 8.3 (inpatient); 17.3 (ED)	<0.001 <0.001 (inpatient and ED) 0.005 (inpatient); 0.001 (ED) 0.039 (inpatient); 0.22 (ED) 0.57 (inpatient); 1.00 (ED) 0.56 (inpatient); 0.93 (ED) 0.64 (inpatient); 0.95 (ED) 0.80 (inpatient); 1.00 (ED)
King, 2008 (40)	Patients admitted to a community hospital for cardiac implant placement (United States)	25	28	Nurse-driven, evidence-based discharge planning protocol vs. traditional discharge planning services (1, 2)	Mean length of hospital stay by 3 d (SD), min Rehospitalizations within 30 d, n Mean unreconciled medications by 3 d (SD) Mean patient satisfaction (DCS) by 7 to 10 d (SD) Mean overall health (HDS) by 7 to 10 d (SD) Mean medication discrepancies between MDP and community pharmacy records by 1 wk (SD) Mean medication discrepancies between MDP and patient self-report by 1 wk (SD)	1567 (436) 3 8.9 (18.4) 26.5 (2.7) 2.6 (0.8) 13.2 (16.6) 10.3 (12.1)	1664 (435) 2 71.8 (21.4) 25.0 (3.2) 3.1 (0.70) 15.3 (18.2) 12.1 (15.3)	0.014 0.52 <0.001 0.050 0.020 0.60 0.60
Lalonde et al, 2008 (41)	Patients admitted to a geriatric and family medicine ward (Canada)	42	41	Enhanced vs. usual MDP (1, 2, 3)	Mean quality of life (SF-36) by 6 wk, PCS score (SD) Mean quality of life (SF-36) by 6 wk, MCS score (SD) Unplanned rehospitalizations within 6 wk, % Emergency visits within 6 wk, %	40.0 (1.3) 6.4 (1.4) 4.3 16	38.4 (1.4) 45.6 (1.4) 3.2 14	NS NS NR NR
Mayo et al, 2008 (42)	Stroke patients returning home directly from 5 acute care hospitals (Canada)	96	94	Postdischarge case management vs. instruction of patients and family to manage postdischarge follow-up (1, 2, 3)	Mean medications patients reported receiving at the time of follow-up within 8 to 12 wk (SD), n Self-perceived medication understanding by patients within 8 to 12 wk Self-reported medication adherence by patients within 8 to 12 wk¶	7.55 (3.27) NR 0.23	7.72 (3.27) NR 0.41	0.66 <0.001 0.028
Vuong et al, 2008 (43)	Patients discharged from 2 acute care tertiary teaching hospitals (Australia)	127	132	Standard care and a home visit from a community liaison pharmacist within 5 d of discharge vs. standard care (discharge counseling, provision of adherence aids, and communication with primary health care providers when necessary)				

Continued on following page

Appendix Table 2—Continued

Study, Year (Reference)	Setting (Country)	Participants, n		Intervention vs. Control (Classification*)	Outcomes†	Results		P Value
		Intervention Group	Control Group			Intervention Group	Control Group	
Afilalo et al, 2007 (44)	Patients consulting a university teaching hospital's ED (Canada)	1048	974	Web-based standardized communication system between ED physicians and GPs vs. usual communication via regular mail (1, 2, 3)	Higher rate of information reception by GP by 21 d, %** More useful information according to GP by 21 d, %** Better knowledge of patient's ED visit by GP by 21 d, %** Better patient management by GPs by 21 d, %** More actions initiated by GP on receipt of information by 21 d, %**	73 59 21 45 32	47 21 21 25 19	SS SS SS SS SS
Schipper et al, 2006 (45)	Patients admitted to general medicine service at a large teaching hospital (United States)	92	84	Enhanced vs. usual pharmacist counseling and follow-up (1, 3)	Preventable adverse events within 30 d, % Preventable, medication-related ED visits or hospitalizations within 30 d, % General patient satisfaction by 30 d, % Any medication discrepancy by 30 d, % Nonadherence to at least 1 medication by 30 d, %	1 1 85 61 54	11 8 88 65 53	NS 0.010 0.030 0.63 >0.99
Preen et al, 2005 (46)	Patients with chronic cardiorespiratory diagnoses from respiratory, cardiovascular, and general medical wards at 2 tertiary hospitals (Australia)	91	98	Enhanced hospital-coordinated vs. usual discharge care plan (1, 2, 3)	Mean quality of life (SF-12) by 7 d, MCS score (SD) Mean quality of life (SF-12) by 7 d, PCS score (SD) Mean patient satisfaction with discharge process by 7 d (SD)††	42.4 (5.6) 27.2 (4.5) 3.2 (0.6)	40.9 (5.7) 27.2 (4.1) 3.0 (0.5)	0.055 NS 0.100
Bolas et al, 2004 (47)	Elderly patients with emergency or unplanned admission who are receiving more than 3 drugs, admitted to the medical unit of a district general hospital (Ireland)	119	124	Hospital-based community liaison pharmacy service vs. standard clinical pharmacy service (1, 3)	Mean GP satisfaction with patient's overall discharge process by 7 d (SD)†† Time taken for discharging hospitals to contact GPs by 7 d Mean length of hospital stay (SD), d	NR NR 11.6 (5.7)	NR NR 12.4 (7.4)	NS 0.002 NS
Coplan et al, 2004 (48)	Elderly patients discharged from the ED at a large medical, school-affiliated, public hospital (Australia)	370	369	Comprehensive Geriatric Assessment vs. usual ED discharge care plan (2, 3)	Mismatch in drug name prescribed in discharge letter and by GP by 10 to 14 d, % Mismatch in drug dose prescribed in discharge letter and by GP by 10 to 14 d, % Mismatch in dosage frequency prescribed in discharge letter and by GP by 10 to 14 d, % Emergency rehospitalizations within 3 mo	10 10 11 NR	17 18 NR	<0.070 <0.004 >0.050
Croft et al, 2004 (49)	Elderly patients making first-time transition from 3 metropolitan public hospitals to a long-term residential care facility (Australia)	56	54	Pharmacist transition coordinator vs. standard hospital discharge summary (1, 2, 3)	Hospitalizations within 1 mo, % Emergency admissions within 1 mo, % GP visits within 1 mo, % Mean quality of prescribing medication (MAI score) by 8 wk Hospital use by 8 wk, %	16.5 11.9 75.9 2.5 5	22.2 14.4 71.5 6.5 13	0.048 0.31 NS 0.007 0.035
Kwok et al, 2004 (50)	Elderly patients with primary diagnosis of chronic lung disease at 2 acute care hospitals (China)	70	79	Intensive CN-supported discharge program vs. usual discharge without CN support (2, 3)	Adverse drug event by 8 wk, % Unplanned rehospitalizations within 28 d, %	45.5 47	43.2 37	0.83 0.24
Naylor et al, 2004 (51)	Elderly patients with heart failure admitted to 6 academic and community hospitals (United States)	118	121	APN-directed vs. non-APN-directed discharge planning and home follow-up protocol (1, 2, 3)	Patients alive and with no rehospitalization within 30 d, % Patients alive and with no rehospitalization within 60 d, % Patients alive and with no rehospitalization within 90 d, % Mean overall quality of life (MLHFQ score) by 2 wk (SD) Mean overall quality of life (MLHFQ score) by 6 wk (SD) Mean overall quality of life (MLHFQ score) by 12 wk (SD) Mean patient satisfaction by 2 wk (SD)†† Mean patient satisfaction by 6 wk (SD)††	86.9 75.0 7.1 3.0 (1.2) 3.1 (1.3) 3.2 (1.5) 83.0 (10.3) 83.1 (9.6)	73.7 62.1 55.8 2.7 (1.2) 2.9 (1.4) 2.7 (1.5) 74.6 (10.4) 77.8 (11.2)	SS SS SS 0.070 NR <0.050 <0.001 <0.001
Wells et al, 2004 (52)	Patients with breast cancer requiring axillary clearance discharged from a teaching hospital (United Kingdom)	54	54	Nurse-led early discharge vs. conventional hospital stay and discharge (2, 3)	Mean quality of life (FACT-B score) by 2 wk\$§ Mean quality of life (FACT-B score) by 4 wk\$§ Mean caregiver strain (CSI score) by 2 wk Mean caregiver strain (CSI score) by 4 wk CN awareness of type of postoperative care patient received, % Information about patient received by CN before surgery, % Information about patient received by CN after surgery, %	109 118 2.5 2.0 65 40 83	108 118 3.3 2.8 2 4 13	NS NS NS NS NS <0.001 <0.001 <0.001

Continued on following page

Appendix Table 2—Continued

Study, Year (Reference)	Setting (Country)	Participants, n		Intervention vs. Control (Classification*)	Results			
		Intervention Group	Control Group		Outcomes	Intervention Group	Control Group	P Value
Lim et al, 2003 (53)	Elderly patients discharged from 4 university-affiliated metropolitan general hospitals (Australia)	311	287	Case management and post-acute care program vs. usual discharge planning (provided by ward nursing staff and social work department) (2, 3)	Mean overall quality of life (AQoL score) by 1 mo†† Mean caregiver strain (CSI score) by 1 mo	0.2 3	0.1 3	0.020 NS
Avlund et al, 2002 (54)	Elderly patients admitted to geriatric, subacute geriatric and medical wards (Denmark)	59	90	Comprehensive follow-up home visits vs. usual discharge services (2, 3)	Rehospitalizations by 3 mo Mean functional ability (BI score) by 3 mo (SD) Decrease in functional ability (BI score) among patients from medical wards by 3 mo, %	NR 84.2 (15.6) 62	NR 82.4 (19.4) 89	NS 0.020*** 0.020
Harrison et al, 2002 (55)	Patients with congestive heart failure admitted to 2 general medical units of a large urban teaching hospital (Canada)	92	100	Hospital-to-home transitional care model vs. usual transfer (2, 3)	Mean quality of life (total MLHFQ score) by 2 wk (SD) Mean quality of life (total MLHFQ score) by 6 wk (SD) Mean quality of life (total MLHFQ score) by 12 wk (SD) Mean quality of life (SF-36) by 2 wk, PCS score (SD) Mean quality of life (SF-36) by 6 wk, PCS score (SD) Mean quality of life (SF-36) by 12 wk, PCS score (SD) Mean quality of life (SF-36) by 2 wk, MCS score (SD) Mean quality of life (SF-36) by 6 wk, MCS score (SD) Mean quality of life (SF-36) by 12 wk, MCS score (SD) Mean quality of life (SF-36) by 2 wk, GHS score (SD) Mean quality of life (SF-36) by 6 wk, GHS score (SD) Mean quality of life (SF-36) by 12 wk, GHS score (SD) All-cause ED visits within 12 wk, % Rehospitalizations within 12 wk, % Patient global independence (mRS) by 6 wk, % Patient ADL independence (BI) by 6 wk, %	32.4 (19.7) 27.3 (19.1) 25.8 (19.4) 30.0 (10.2) 30.9 (11.7) 32.1 (11.8) 52.3 (12.2) 53.5 (10.5) 53.9 (12.3) 55.1 (23.8) 51.0 (11.5) 48.5 (22.9) 49.3 (25.1) 46 29 31 23 54.4 56.3	39.0 (19.5) 37.5 (20.3) 38.4 (18.2) 28.7 (10.2) 29.4 (11.0) 28.3 (10.0) 49.3 (11.9) 49.5 (11.3) 51.0 (11.5) 52.6 (24.5) 48.5 (22.9) 49.3 (25.1) 46 29 31 23 54.6 48.8	NR 0.002 <0.001 NR 0.82 0.070 NR NR NR NR 0.26 0.070 0.43 0.030 0.26 0.118 0.179
Indredavik et al, 2000 (56)	Patients with stroke admitted to a stroke unit (Norway)	160	160	Extended stroke service unit with early supported discharge vs. ordinary stroke unit service without service from mobile stroke team (1, 2, 3)	Rehospitalizations by 3 mo, % Deaths by 3 mo, % Outpatient department attendance by 3 mo, % GP attendance by 3 mo, % Days in hospital as percentage of days of follow-up by 3 mo	96 96 96 76 0	100 100 100 82 0	NS NS NS NS NS
Nazareth et al, 2001 (57)	Elderly patients with 4 or more medicines discharged from 3 acute general hospitals and 1 long-stay hospital (United Kingdom)	181	181	Pharmacy discharge plan vs. discharge procedures (1, 2, 3)	Mean general patient well-being by 3 mo (SD)††† Mean patient satisfaction by 3 mo (SD)††† Mean patient adherence to medicines by 3 mo (SD)§§§ Mean patient knowledge about medicines by 3 mo (SD)§§§ Mean patient hoarding of medicines by 3 mo (SD)§§§	2.4 (0.7) 3.3 (0.6) 0.8 (0.3) 0.7 (0.3) 0.006 (0.04)	2.4 (0.6) 3.3 (0.6) 0.8 (0.3) 0.6 (0.3) 0.005 (0.03)	NS NS NS NS NS
Rutherford and Burge, 2001 (58)	Patients with cancer admitted for major surgery at an oncology unit (Australia)	50 (invited), 50 (discharge summary)	50 (invited), 50 (discharge summary)	GPs invited to hospital vs. noninvited GPs and special discharge summary vs. routine discharge summary (1, 2, 3)	GP hospital visits (reported by GPs) by 4 to 6 wk, % GP hospital visits (reported by patients) by 4 to 6 wk, % GP-reported telephone calls from GP to hospital by 4 to 6 wk, % Patient-reported telephone calls from GP to hospital by 4 to 6 wk, % Patient satisfaction with GP management of postdischarge problems by 4 to 6 wk Patient confidence in GP management of future problems by 4 to 6 wk GP confidence in management of patients' future problems by 4 to 6 wk	29 23 79 47	4.7 2 30.1 12	<0.001 <0.001 <0.001 <0.001 NS NS NS
McInnes et al, 1999 (59)	Elderly patients admitted to geriatric units of a district hospital and a teaching hospital (Australia)	205	159	GP input into discharge planning vs. usual care (1)	Patient satisfaction with discharge planning by 6 wk, % Patients recommended for support services (in community setting) at discharge, %	93 12	82 19	0.030 0.030

Continued on following page

Appendix Table 2—Continued

Study, Year (Reference)	Setting (Country)	Participants, n		Intervention vs. Control (Classification*)	Results		P Value
		Intervention Group	Control Group		Outcomes	Intervention Group	
Naylor et al, 1999 (60)	Elderly patients with medical and surgical reasons for admission at 2 urban, academically affiliated hospitals (United States)	177	186	APN-centered comprehensive discharge planning and home follow-up (protocol) vs. routine discharge planning (2, 3)	17	47	<0.001
van Walraven et al, 1999 (61)	Patients discharged from a general internal medicine service at a tertiary care teaching hospital (Canada)	142	151	Database-generated discharge summaries vs. dictated discharge summaries (1, 3)	79.6 72.7 (19.3) 73.4 (19.8) 77.4 (16.3) 70.3 (21.9)	57.0 74.9 (16.6) 78.2 (14.9) 79.3 (17.2) 66.2 (25.6)	<0.001 NR NR NR NR
Siu et al, 1996 (62)	Elderly patients admitted to the medical and surgical services of a hospital (United States)	178	176	Postdischarge geriatric assessment vs. routine medical discharge care (1, 2, 3)	43 7	37 8	0.40 NR
Rich et al, 1993 (63)	Elderly patients with congestive heart failure admitted to the medical ward of a secondary and tertiary care university teaching hospital (United States)	40 (moderate-risk patients), 23 (high-risk patients)	21 (moderate-risk patients), 14 (high-risk patients)	Comprehensive multidisciplinary treatment strategy vs. conventional discharge treatment (1, 2, 3)	33.3 27.5 43.5 31.8 (5.1)	45.7 47.6 42.9 42.1 (7.3)	NS 0.100 NS NS
				Overall rehospitalization within 90 d, %	35.1 (9.0)	28.6 (7.2)	NR
				Rehospitalization rates (moderate-risk patients) by 90 d, %	27.8 (3.5)	60.2 (10.5)	0.026
				Rehospitalization rates (high-risk patients) by 90 d, %			
				Mean overall total days to first rehospitalization within 90 d (SD)			
				Mean overall total days to first rehospitalization (moderate-risk patients) within 90 d (SD)			
				Mean overall total days to first rehospitalization (high-risk patients) within 90 d (SD)			

ADL = activities of daily living; APN = advanced practice nurse; AQoL = Assessment of Quality of Life; BI = Barthel Index; CN = community nurse; CSI = Caregiver Strain Index; DCS = Discharge Composite Score; ED = emergency department; FACT-B = Functional Assessment of Cancer Therapy-Breast; GHS = General Health Subscale; GP = general practitioner; HDS = Hospital Discharge Survey; MAI = Medication Appropriateness Index; MCS = Mental Component Summary; MDP = medication discharge plan; MLHFQ = Minnesota Living with Heart Failure Questionnaire; mRS = modified Rankin Scale; NR = not reported; NS = nonstatistically significant (no *P* value reported); PCS = Physical Component Summary; SF-12 = Short Form-12; SF-36 = Short Form-36; SIMS = Satisfaction with Information about Medicines Scale; SS = statistically significant (no *P* value reported).
* Intervention 1 consists of components that aim to improve the quality of information that is exchanged (e.g., completeness, clarity, and accuracy of information). Intervention 2 consists of components that aim to improve the coordination of care (e.g., assessment, planning, and organization of follow-up services and needs). Intervention 3 consists of components that aim to improve communication (e.g., personal and direct contact, accessibility, and timeliness of information).

† Outcome measures within 3 mo after discharge and relevant for identifying the effect of intervention on handover between hospital and primary care providers.

‡ Delivery of discharge summary by e-mail and fax was significantly more effective than mail and patient hand delivery (*P* < 0.001).

§ Measured with the Brief Medication Questionnaire Regimen Screen (score ≥ 1 indicates that patient is potentially nonadherent).

|| Rated on a visual analogue scale of 0 to 100.

¶ Measured with the Modified Morisky Scale for self-reported adherence (lower score indicates better adherence).

** Measured with a Web-based questionnaire for GPs with transformed dichotomous outcomes.

†† Rated on a 5-point Likert scale.

††† Measured with an investigator-developed and -tested instrument with 25 items self-rated on a point scale of 0 to 4 and a range of 44 to 100 (higher scores reflect greater satisfaction).

§§ Interpreted from Figure 3 in Wells et al (52) (scale of 100 to 130).

¶¶ Interpreted from Figure 3 in Wells et al (52) (scale of 0.0 to 5.0).

¶¶¶ Interpreted from Figure 4 in Wells et al (53) (scale of -0.10 to 0.25).

*** Difference in BI score statistically significant only for patients from the medical wards.

†††† Measured with a British adaptation of the general well-being questionnaire (22 items scored from 1 to 5).

††††† Measured with a client satisfaction questionnaire (7 items scored from 1 to 4).

§§§ Validated self-report semistructured interview rated from 0 (none) to 1 (total/highest level).

||||| GPs' assessments of discharge summaries rated on visual analogue scale of 0 to 100.

Appendix Table 3. Quality Rating of Included Studies

Study, Year (Reference)	Randomization	Allocation Concealment	Similarity of Groups at Baseline	Inclusion/Exclusion Criteria Specified	Providers/Participants Blinded	Assessors Blinded to Outcome	Attrition Rate Reported	Characteristics of Participants Lost to Follow-up Described	Intention-to-Treat Analysis	Power Analysis Calculated	Total
Arbaje et al, 2010 (28)	Yes	Unknown	Yes	Yes	NP	Yes	Yes	Yes	Yes	Yes	8
Chen et al, 2010 (29)	Yes	Yes	Yes	Yes	NP	Unknown	Yes	Yes	No	No	6
Eggink et al, 2010 (30)	Yes	No	Yes	Yes	NP	No	Yes	No	No	Yes	5
Ryhter et al, 2010 (31)	Yes	Yes	No	Yes	NP	Unknown	No	Yes	Yes	Yes	6
Shyu et al, 2010 (32)	Yes	Unknown	Yes	Yes	NP	Yes	Yes	Yes	Yes	Yes	8
Graumlich et al, 2009 (33, 34)*	Yes	Yes	Yes	Yes	NP	Yes	Yes	Yes	Yes	Yes	9
Jack et al, 2009 (35)	Yes	Yes	Yes	Yes	NP	Yes	Yes	Yes	Yes	Yes	9
Koehler et al, 2009 (36)	Yes	Yes	Yes	Yes	NP	Yes	Yes	Yes	Yes	No	8
Lin et al, 2009 (27)	Yes	No	No	Yes	NP	No	No	No	No	No	2
Maslove et al, 2009 (37)	Yes	No	Yes	Yes	NP	No	Yes	Yes	Unknown	Yes	6
Schipper et al, 2009 (38)	Yes	Yes	Yes	Yes	NP	No	Yes	Yes	Yes	Yes	8
Tripp, 2009 (39)	Yes	Unknown	No	Yes	NP	Unknown	No	No	Yes	Yes	4
King, 2008 (40)	Yes	Yes	Yes	Yes	NP	Unknown	Yes	Yes	No	Yes	7
Lalonde et al, 2008 (41)	Yes	Yes	Yes	Yes	NP	Yes	No	No	Yes	Yes	7
Miayo et al, 2008 (42)	Yes	Yes	Yes	Yes	NP	Yes	Yes	Yes	Yes	Yes	9
Vuong et al, 2008 (43)	Yes	Yes	No	Yes	NP	Unknown	Yes	Yes	Unknown	Yes	6
Afilalo et al, 2007 (44)	Yes	Yes	Yes	Yes	NP	No	Yes	No	Yes	Yes	7
Schipper et al, 2006 (45)	Yes	Yes	Yes	Yes	NP	Yes	Yes	Yes	Yes	Yes	9
Preen et al, 2005 (46)	Yes	Yes	Yes	Yes	NP	Unknown	No	No	Yes	Yes	6
Bolas et al, 2004 (47)	Yes	Yes	Yes	Yes	NP	Unknown	Yes	Yes	Unknown	Yes	6
Caplan et al, 2004 (48)	Yes	No	Yes	Yes	NP	No	Yes	Yes	Unknown	Yes	6
Crotty et al, 2004 (49)	Yes	Yes	No	Yes	NP	Yes	Yes	Yes	Yes	Yes	8
Kwok et al, 2004 (50)	Yes	Yes	No	Yes	NP	No	Yes	Yes	No	Yes	6
Naylor et al, 2004 (51)	Yes	Yes	No	Yes	NP	Yes	Yes	Yes	Yes	Yes	8
Wells et al, 2004 (52)	Yes	Unknown	Yes	Yes	NP	No	Yes	Yes	Yes	Yes	7
Lim et al, 2003 (53)	Yes	Yes	Yes	Yes	NP	Yes	Yes	Yes	Yes	Yes	9
Avlund et al, 2002 (54)	Yes	No	Yes	Yes	NP	Yes	Yes	Yes	No	Yes	7
Harrison et al, 2002 (55)	Yes	Yes	Yes	Yes	NP	No	Yes	Yes	Yes	Yes	8
Indredavik et al, 2000 (56)	Yes	Yes	Yes	Yes	NP	Yes	Unknown	No	Yes	No	6
Nazareth et al, 2001 (57)	Yes	Yes	Yes	Yes	NP	Unknown	Yes	Yes	Unknown	Yes	7
Rutherford and Burge, 2001 (58)	Yes	Yes	Yes	No	NP	Unknown	Yes	Yes	No	No	5
McInnes et al, 1999 (59)	Yes	Yes	Yes	Yes	NP	Unknown	Yes	No	Yes	No	6
Naylor et al, 1999 (60)	Yes	Yes	Yes	Yes	NP	Yes	Yes	Yes	Yes	Yes	9
van Walraven et al, 1999 (61)	Yes	Yes	No	Yes	NP	Unknown	Yes	Yes	No	Yes	6
Siu et al, 1996 (62)	Yes	Yes	No	Yes	NP	Yes	Yes	Yes	Yes	No	7
Naylor et al, 1994 (26)	Yes	Unknown	No	Yes	NP	No	Yes	No	No	No	3
Rich et al, 1993 (63)	Yes	Yes	Yes	Yes	NP	No	Yes	No	No	No	5

NP = not possible.

* Two separate studies using the same intervention, setting, and population but different outcome measures.