



Effective Interventions to Reduce Rehospitalizations: *A Survey of the Published Evidence*

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Effective Interventions to Reduce Rehospitalizations: A Survey of the Published Evidence

Introduction

Rehospitalization—patient admission to a hospital soon after discharge—is both common and costly. In the majority of situations, hospitalization is necessary and appropriate. However, nearly one in every five elderly patients who are discharged from the hospital is rehospitalized within 30 days.¹ Many of these rehospitalizations are avoidable, and thus suggest a failure in the systems of establishing patients stably and safely in a new setting of care. Avoiding preventable rehospitalizations represents a win-win opportunity for patients and families, payers, health care purchasers, and providers.

Investigators working in a range of clinical settings have identified effective methods for reducing avoidable rehospitalizations. The Institute for Healthcare Improvement (IHI) has produced this two-part series of background materials to highlight promising approaches to reduce avoidable rehospitalizations. This document is a survey of the published literature regarding the effective interventions to reduce avoidable rehospitalizations. The companion document in this series, *Effective Interventions to Reduce Rehospitalizations: A Compendium of Promising Interventions*, provides information regarding current best programs and practices to reduce rehospitalizations.

Our survey of the published evidence revealed that the current body of published interventions to reduce rehospitalizations fall into four broad categories: 1) enhanced care and support during transitions; 2) improved patient education and self-management support; 3) multidisciplinary team management; and 4) patient-centered care planning at the end of life.

Purpose and Methods

The intent of our survey of the published literature was to review the evidence for effective interventions to reduce rehospitalizations across patient populations and settings of care. We conducted a PubMed search of the published literature to find evidence of the effectiveness of interventions to improve transitions of care and reduce rehospitalizations. As this is a very broad topic, we narrowed the search strategy by limiting our consideration of articles by publication date (to those articles published fewer than 10 years from September 2008), English, and US-based studies. Search terms included: “transitions of care,” “re-hospitalizations,” “readmissions,” “unnecessary hospitalization,” “avoidable hospitalization,” “reducing hospitalization,” “reduce re-hospitalization,” “reduce readmissions,” “readmissions mental illness,” “readmissions dementia,” “readmissions end of life,” “interventions reduce rehospitalization,” “case management,” “community reduce readmission,” “discharge planning readmission,” and “home care readmission.” Each search returned well over 1,000 results. For each search result, a practicing physician reviewed up to 500 results based on these limits and selected roughly 100 articles for consideration by the research team for further review. The research team selected approximately 25 articles from each group to review in detail. In total, the number of articles reviewed for this survey of evidence was 158.

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We encountered a heterogeneous collection of studies and findings. Foci of studies were variably on: 1) the epidemiology of avoidable hospitalizations and rehospitalizations from specific settings of care (such as from nursing homes, or from home health care); 2) specific service interventions (such as enhanced patient and family education, or use of home telemonitoring); or 3) interventions for patients with specific diseases (such as heart failure, chronic obstructive pulmonary disease, or hip fracture).

When the review team encountered complex interventions that crossed numerous categories of intervention, we attempted to describe the intervention in only one category, according to our assessment of the primary focus on the intervention.

Results

IHI's analysis of the findings of this broad literature survey revealed the following four categories of interventions to reduce rehospitalizations: 1) enhanced care and support at transitions; 2) improved patient education and self-management support; 3) multidisciplinary team management; and 4) patient-centered care planning at the end of life.

1. Enhanced Care and Support at Transitions

Studies in this category included those which provided: a) improved discharge processes; b) early post-discharge follow-up; c) front-loaded home care visits; d) remote monitoring; or e) nurse-led transition care services.

a. Improved discharge processes

The strongest evidence supporting the effectiveness of improving hospital-based discharge processes is provided by the Project RED (Re-Engineered Discharge) intervention.² The Project RED intervention centers around the assignment of a nurse discharge advocate, who works with patients during the hospitalization to conduct patient education, arrange post-acute follow-up, confirm medication reconciliation, and prepare an individualized discharge instruction booklet for the patient that is also sent to the primary care provider. The Project RED intervention also includes a follow up phone call from a pharmacist to the patient 2 to 4 days post-discharge to confirm the follow-up plan and to review medications. Project RED reduced the incidence of subsequent hospital utilization (either ED or inpatient visit) within 30 days by 30% (RR= 0.695; 95% CI 0.515 to 0.937; p=0.009). The intervention was most effective among participants with hospital utilization in the 6 months before index admission (p=0.014).

A second intervention designed to improve the existing discharge process was conducted by Balaban and colleagues.³ This intervention focused on enhancing communication

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between the inpatient and outpatient providers by designing a user-friendly discharge form, which was reviewed with the patient prior to discharge, and electronically sent from the inpatient nurse to the nurse in the outpatient primary care practice. The outpatient nurse followed up with a telephone call to review the post-discharge plan, and the patient's primary care physician reviewed and modified this plan of care as needed. Four undesirable outcomes were measured after hospital discharge: 1) no outpatient follow-up within 21 days; 2) readmission within 31 days; 3) emergency department visit within 31 days; and 4) failure by the primary care provider to complete an outpatient workup recommended by the hospital doctors. Outcomes of the intervention group were compared to concurrent and historical controls. Only 25.5% of intervention patients had 1 or more undesirable outcomes compared to 55.1% of the concurrent and 55.0% of the historical controls. Only 14.9% of the intervention patients failed to follow-up within 21 days compared to 40.8% of the concurrent and 35.0% of the historical controls. Only 11.5% of recommended outpatient workups in the intervention group were incomplete versus 31.3% in the concurrent and 31.0% in the historical controls. Of note, when the impact on 30-day readmission rates was analyzed in isolation from the other three undesirable outcomes, there was no significant effect (8.5% readmission in the intervention group, 8.2% readmission in concurrent control and 14% readmission in historical control).

In a study of patients with psychiatric disorders, Reynolds and colleagues found that when inpatient staff continued to work with discharged patients until a working relationship with an outpatient provider was established, fewer patients were rehospitalized than in the control group.⁴

b. Early post-discharge follow-up

A high percentage of rehospitalizations occur in the days to weeks following discharge.¹ A review of unplanned readmissions from home care found the crucial time period for rehospitalization is the first 2 to 3 weeks following hospital discharge;⁵ another review of home care readmissions found that 35% of patients had experienced at least one rehospitalization within 2 to 14 weeks following hospital discharge.⁶ A national Medicare analysis found 50% of patients who were rehospitalized within 30 days had no intervening physician visit between discharge and rehospitalization.¹ Therefore, we included in our survey of the literature a scan for interventions that focused on the effect of early post-hospital follow-up on rehospitalization rates.

The most extensive review of the impact of comprehensive discharge planning and post-discharge support was conducted by Phillips.⁷ Phillips reviewed 18 studies, which included over 3,000 patients (n=3,304). The mean age range of participants was 56 to 79 years and the average follow-up period was 9.8 months (range 3 to 12). All studies included what the authors referred to as "comprehensive discharge planning"—usually with medication review and anticipatory guidance on discharge from the hospital. Post-

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discharge elements were variable and these authors attempted to sort studies into the following groups:

- Single home visit—three studies. Patients in this group received from 1 to 3.5 hours of intervention.
- Increased clinic follow-up and/or frequent telephone contact—four studies, one of which also included a home visit. Patients in this group received 2 weeks to 6 months of total intervention.
- Home visit and/or frequent telephone contact—six studies, three of which had both home visits and telephone contact. Patients in this group received 3 to 6 months of total intervention.
- Studies with “components intended to provide continuous multidisciplinary home care”—four studies. These were essentially studies with more than two disciplines represented and characterized by long-term implementation (2 to 12 weeks), with at-home care being a central part of the intervention. One of these studies had an intervention lasting up to 1 year.

The Phillips meta-analysis found that comprehensive discharge planning and post-discharge support reduced rehospitalizations by 25% overall (relative risk 0.75; CI 0.64 to 0.88; NNT 12).

Other studies supporting early post-discharge follow-up include the following:

- An intervention that enhanced nurse education about heart failure and focused specifically on mitigating the majority of rehospitalizations that occur in the first 2 weeks post-discharge reported a reduction in all-cause 30-day readmission rates (18% vs. 6%) when follow-up appointments were made 7 to 10 days post-discharge. Additionally, heart failure-specific readmission rates decreased from 7.3% to 1.7%.⁸
- Jerant and colleagues found that follow-up phone calls by nurses to patients with heart failure resulted in significantly fewer emergency room visits ($p=0.03$), and a non-significant trend toward fewer rehospitalizations. Mean costs for heart failure-related rehospitalizations were \$5,850 for the intervention cohort and \$44,479 for the usual care cohort ($p=0.2$).⁹
- Stewart and colleagues showed that a home visit one week after discharge by a nurse and a pharmacist to optimize medication management reduced unplanned readmissions for patients with congestive heart failure by about 50%.¹⁰
- Patients with severe heart failure who received more intense care—consisting of examination by internists and a trained paramedical team at least once a week at

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home—had a lower hospitalization rate than during the year prior to the intervention.¹¹

Other studies utilizing similar strategies for early post-discharge follow-up care did not show evidence of effectiveness. Campbell and colleagues tested a clinical practice guideline of conducting a telephone follow-up call 48 to 72 hours after a patient was discharged from the ED with community-acquired pneumonia; they found no effect on patient outcomes, including rehospitalization rates.¹² Carroll and colleagues used similar strategies of early follow-up care, including home visits within 72 hours and telephone calls from an advanced practice nurse at 2, 6, and 12 weeks post-discharge. A peer advisor also made 12 weekly phone calls to the patients. At 3 weeks and 6 months, there was no change in rehospitalization rates.¹³

c. Front-loaded home care visits

Front-loading home care services to increase the number of visits in the immediate post-hospitalization period proved to be effective in decreasing rehospitalization rates for patients with heart failure (39.4% vs. 15.8%, $p < 0.001$), but not for patients with insulin dependent diabetes.¹⁴ A similar program implemented front-loaded home visits, combined with intensified focus on care coordination between providers; this program reduced unplanned readmissions by only 2.6% over a 6-month period.¹⁵

d. Remote monitoring

A large body of evidence exploring the effect of various remote monitoring strategies exists with a large proportion of the studies focusing on patients with heart failure. Remote monitoring interventions vary by inclusion of other elements of enhanced team management and/or closer follow-up, nature and intensity of patient education or self-management training, and number and duration of telephone contacts.^{9,16,17,18, 19,20,21,22} We included 8 articles in this discussion.

Due to this variation, it is difficult to assess the isolated effect of remote monitoring on rehospitalization rates. The range of effect on reducing rehospitalizations (variably measured at 30 days to 1 year) ranged from a low of 14% to a high of 80%.^{16,17,18,19,20} Overall, interventions which added some element of closer follow-up, patient education and contact over time were effective in reducing the frequency of hospitalizations (largely in patients with heart failure).^{16,17,18,19,20} However, it is notable that an intervention which provided intensive telephone-based case management and patient education to a Hispanic population failed to show any beneficial effect on hospitalization rates.²²

The variety of remote monitoring strategies is demonstrated by a systematic review of 9 studies by Chaudhry and colleagues.¹⁷ The studies explored telephone-based symptom

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monitoring, automated monitoring of signs and symptoms, and automated physiologic monitoring. Among the 9 studies, 6 suggested a reduction in all-cause hospitalizations (ranging from 14% to 55%) and heart failure hospitalizations (ranging from 29% to 43%).

Other studies demonstrating the effectiveness of remote monitoring include the following:

- Slater and colleagues incorporated multidisciplinary team management, inpatient education, as well as an outpatient telephonic program to reinforce education after discharge. This 3-month long program reduced heart failure rehospitalizations from 854 to 200.¹⁸
- Nurse telemanagement as a remote monitoring alternative to weekly home nurse visits was studied by Benatar and colleagues.¹⁶ In the nurse telemanagement program, home monitoring devices were utilized by patients to measure weight, blood pressure, heart rate, and oxygen saturation. Patients transmitted their data to a secure Internet site, and caregivers then monitored patients through this site. In addition, any abnormal physiological data sent an alarm and the patient's home telephone number to alphanumeric pagers to allow for prompt response by nurses. After 3 months, this intervention was associated with 13 rehospitalizations due to heart failure, compared to 24 rehospitalizations for the home nurse visit group ($p \leq 0.001$).
- A call center that provided 24/7 hotline support as well as a registered nurse who contacted patients on a regular basis was associated with an approximately 80% reduction in congestive heart failure (CHF) readmissions. The 6-week long telemanagement program reduced the CHF readmission rate from 12% to 2%.¹⁹
- At the Fuqua Heart Center of Atlanta at Piedmont Hospital, patients self-managed their condition and provided nursing staff with information using a user-friendly touch screen monitor. Nurses contacted patients that did not report for an extended period of time. Thirty-day readmission rates for heart failure patients were reduced from 5.85% to 1.45%, a 75% decrease.²⁰

Other studies with similar interventions showed a trend towards reducing rehospitalizations but did not reach statistical significance. In a study by Donald and colleagues,²¹ asthma patients were given a peak expiratory flow meter and asked to monitor themselves for at least a week, after which they met with a nurse for face-to-face asthma education. In the ensuing 6 follow-up calls, patients were asked about their asthma symptoms and management and offered advice and encouragement. While the 12-month readmission total was reduced from 20 in the control group to 1 in the intervention

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group, it did not reach statistical significance. When comparing the effectiveness of 3 interventions—home telecare delivered via a 2-way video-conference device with an integrated electronic stethoscope, nurse telephone calls, and usual outpatient care—Jerant and colleagues found no statistically significant difference in rehospitalization rates for heart failure patients.⁹

e. Nurse-led transition care services

In addition to interventions which aim to improve the existing discharge process, many investigators have developed programs that enhance the care provided to patients during the period of transition out of the hospital. Overall, these programs generally include the use of nurses in varying capacities as coaches, clinical specialists, patient educators, and clinical coordinators of care.^{4,23,24,25,26,27,28,29,30}

The Care Transitions intervention, developed by Coleman and colleagues, centers on providing community-dwelling patients at high risk of rehospitalization with a transition coach in the post-acute hospital period. Coaching focuses on engaging patients as active participants in their own care, as well as encourages patients to clarify and/or follow up on recommended discharge instructions. The results of a randomized controlled trial of the Care Transitions intervention found a statistically significant decrease in both 30- and 90-day rehospitalization rates (30-day = 8.3% vs. 11.9 %, $p=0.048$; 90-day= 16.7% vs. 22.5%, $p=0.04$).^{23,31}

Naylor and colleagues developed a transitional care model for frail adults that provides 3 months of clinical care and coordination in the post-acute period by an advance practice nurse (APN). The APN provides comprehensive discharge planning and home visit follow up, facilitates patient and caregiver identification of goals of care, and coordinates care. At 52 weeks (1 year) post-discharge, the intervention group had a statistically significant reduction in total rehospitalizations (reduced from 162 in the control group [n=121] to 104 in the intervention group [n=118], $p=0.47$).²⁴

A similar intervention that provided home visits using advanced practice nurses to direct and supervise a pulmonary disease management program for patients with COPD, 24-hour nurse contact, complex care coordination services, and assistance with patient and family needs demonstrated a reduction in rehospitalizations for COPD patients from 28.2% (control group) to 9.8% (intervention group), $p>0.05$.²⁶ An intervention testing the effect of frequent contact with a geriatric nurse before and after discharge for elderly patients hospitalized with hip fracture resulted in fewer rehospitalizations than among controls.³²

Chiu conducted a review of 15 nurse-led post-hospital transition interventions and found that 8 studies showed an effect in reducing rehospitalizations by at least 33%.²⁵ Chiu and colleagues concluded that effective interventions included the following: communication

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tools, patient activation, nurse-led coaching, one-hour education sessions, telephone outreach, comprehensive discharge planning, and home follow-up visits.²⁵ However, the results of several other studies that included many of these elements of success failed to demonstrate a reduction in rehospitalization rates.^{4,28,29,33}

2. Improved Patient Education and Self-Management Support

We found that the majority of case management or disease management interventions relied heavily on either improved patient education or increasing competency in self-management support. These interventions are described below.

Patient education and self-management support

Patient education, while not the sole focus of intervention studies, were a major focus of nine articles we reviewed.^{18,34,35,36,37,38,39,40,41} Educational interventions included a variety of modalities and services, and were provided across a variety of settings. Educational interventions ranged from encouraging active self-management to symptom education. Interventions reviewed primarily consisted of additional time spent on education and self-management instruction in the inpatient setting.

Among individuals with schizophrenia, symptom education was associated with a reduction in 90-day rehospitalization rates for schizophrenia from 36.0% to 21.6% ($p=0.03$).³⁶ Among patients with chronic heart failure, a 1-hour one-on-one patient education session with a trained nurse educator reduced the risk of rehospitalization or death (RR 0.65; 95% CI 0.45-0.93; $p=0.018$) over a 6-month time frame of post-discharge follow-up.³⁷ A similar intervention which emphasized patient education to increase adherence to medication and diet regimens and recognize early symptoms of exacerbation reduced readmissions by 35% over 9 months.³⁹

A meta-analysis of randomized controlled trials (RCTs) that evaluated the effect of heart failure-specific patient education coupled with post-discharge follow-up assessment found a 21% reduction in the relative risk of rehospitalization (pooled RR 0.79; 95% CI 0.68-0.91; $p<0.001$) over 3 to 12 months of follow up.³⁴ A systematic review of RCTs examining self-management interventions in which patients retain the primary role of self-monitoring and determining when medical attention is needed was associated with a reduced risk of rehospitalization for heart failure by 56% (OR 0.44; 95% CI 0.27-0.71), reduced all-cause rehospitalization by 41% (OR 0.59; 95% CI 0.44-0.8; $p=0.001$), and lower per patient costs.³⁵

Not all studies reviewed found a positive effect of patient education or self-management support interventions. A randomized controlled trial of a formal education and support intervention among heart failure patients reported a non-significant 39% decrease in total number of rehospitalizations after 1 year of follow-up ($p=0.6$).⁴⁰

Disease management or case management

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We reviewed 19 studies examining the effect of a variety of case management or disease management interventions. The majority of studies were conducted with a focus on patients with heart failure, although some studies focused on patients with COPD or a general medical population. The largest and most robust study, a meta-analysis of the results of 15 randomized controlled trials,⁴² examined the effect of case management on Medicare patients with a range of chronic conditions.

A systematic review of 36 RCTs on the effect of disease management programs for heart failure found that while only 6 out of 32 studies reported statistically significant reductions in rehospitalizations, the pooled statistics were significant for reducing the first rehospitalization by 8% and subsequent all-cause rehospitalizations by 19%.⁴³

Kimmelstiel and colleagues conducted a randomized controlled trial of the short-term and long-term effects of disease management across a diverse provider network. The intervention consisted of a home visit from an experienced nurse, meeting with the patient and family/caregivers, that focused on education and self-management support principles with instruction and phone numbers given to call the nurse at any time with a change in clinical status. The intervention resulted in statistically significant fewer heart failure-related hospitalizations at 90 days (RR 0.48; p=0.027), however there was a loss of long-term effect after 90 days.⁴⁴

A notably successful case management intervention is reported by Kane and colleagues' evaluation of the Evercare intervention.⁴⁵ In brief, Evercare segments patients who enroll in their Medicare + Choice managed care product into four risk strata and employs different levels of intensity of nurse practitioner (NP) follow up, depending on the risk category. Each NP has a caseload of approximately 100 residents who are usually located in one or two nursing homes. A 2004 analysis of the effect of the Evercare program found a significantly lower average number of hospital admissions per 100 enrollees (0.35 intervention vs. 0.89 control).

We reviewed publications supporting enhanced or intensive case management services when compared to "usual care" case management. Kuno showed intensive case management was associated with statistically significant reductions in the number of hospitalizations for patients with serious mental illness over a 1-year follow up,⁴⁶ and Casas and colleagues found that an integrated care intervention that included access to a specialized case manager resulted in significantly fewer rehospitalizations among patients with COPD.⁴⁷

Other studies demonstrating the effectiveness of disease management or case management on reducing rehospitalizations include the following:

- Gorski and colleagues found that an aggressive patient education program combined with telehealth with targeted nurse-initiated phone call outreach

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- decreased hospitalizations for patients with heart failure from 22.6 to 14.6 per 1,000 enrollees; a 35% decrease.³⁹
- An enhanced heart failure program which included and increased provision of both patient education (which was actually a 3-month education program for nurses) as well as integrated care management services was successful in documenting a decrease in 30-day all-cause readmission rates from 18% to 6% and heart failure-specific readmissions from 7% to 1.7%.⁸
 - Patients treated in a short-term, specialized heart failure clinic had a trend toward lower risk of rehospitalization at 30 days (relative risk reduction 77%, 3% vs. 13%; $p=0.08$) and a statistically significant lower rehospitalization rate at 90 days and 1 year (5% vs. 23%, $p<0.02$ for 90 days; 16% vs. 31%, $p<0.03$ for 1 year) than patients who received usual care.⁴⁸

We reviewed several studies which failed to find that enhanced case management services decreased hospitalizations. A study of 15 Medicare demonstration programs employing case management for Medicare patients in a variety of settings failed to find that the case management services decreased hospitalizations, potential preventable hospitalizations, or overall Medicare costs.⁴² Additionally, there was no documented improvement in any of the adherence measures resulting from the self-management support training.

A meta-analysis conducted by Harris and colleagues on 12 RCTs studying hospital-based case management showed no difference between the hospital-based case management intervention and usual care (OR 0.87; 95% CI 0.69-1.04).⁴⁹ A systematic review of 9 studies for disease management for COPD patients failed to detect a difference between disease management interventions and usual care.⁵⁰

Six additional studies failed to demonstrate statistically significant decreases in hospitalizations as a result of disease management interventions. A comprehensive disease management intervention for general medical outpatients included early post-discharge case manager follow up within 7 days of discharge, subsequent home visits, and proactive telephone contact over 6 months. This intervention did not find a statistically significant difference in unscheduled rehospitalizations, quality of life, or psychological functioning.⁵¹ An in-hospital discharge planning and case management protocol for geriatric patients incorporated many principles of patient-centeredness and self-care, but failed to demonstrate a difference in 15- and 90-day rehospitalization rates.⁵²

Similarly, a phone-based disease management program for “low risk” patients with heart failure consisting of telephone-based education and self-management instruction, combined with an average of 9 hours per patient of care coordination over 1 year, failed to show positive results. After 1 year, there was a 50% rehospitalization rate in both

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groups, 32% to 37% of which was attributed to heart failure.⁵³ A similar intervention consisting of high-frequency proactive telephone contact with a decreasing level of intensity, length, and frequency over a 6-month follow-up period also failed to demonstrate a significant reduction in all-cause rehospitalization rates at either 3 months or 6 months.²²

3. Multidisciplinary Team Management

There is an extensive body of research describing the effects of multidisciplinary team management on outcomes relating to rehospitalizations. Our scan included 3 systematic reviews, each of which reviewed 29, 30 and 11 articles, and 8 additional studies.

Multidisciplinary team management is a heterogeneous term encompassing a wide range of specific services over a variable amount of time. On the whole, the core elements of multidisciplinary team management include utilization of a wide range of clinical expertise in a variety of settings across the continuum of care. Multidisciplinary interventions include nurse-led programs; specialty-based follow-up; medication review; medication adherence interventions; patient education; enhanced monitoring; nutrition, exercise, physical, occupational, and speech therapy; and/or social work. The majority of studies focused exclusively on patients with heart failure, although we also reviewed studies of patients with other cardiac disease, atrial fibrillation, dementia, and hip fracture.

Overall the evidence for multidisciplinary team management is mixed. Even the nature of the term “multidisciplinary team management” is a broad category, and individual studies investigated the impact of approaches that varied in team composition, intensity, coordination, and diversity of clinical disciplines. When effective, these interventions reduced hospitalization rates by approximately 20% to 25%.^{48,54,55,56,57,58} However we reviewed numerous studies which found no change in hospitalization rates.^{30,59,60}

Three recent systematic reviews found that multidisciplinary team management for patients with heart failure resulted in reduced hospitalizations. Holland and colleagues found multidisciplinary team management was associated with reduced all-cause rehospitalizations (RR 0.87; 95% CI 0.79-0.95; $p=0.002$) and reduced heart failure-specific rehospitalization (RR 0.7; 95% CI 0.61-0.81; $p<0.001$).⁵⁴ McAlister and colleagues found that multidisciplinary team management reduced heart failure rehospitalizations (RR 0.74; 95% CI 0.63-0.87) as well as all-cause rehospitalizations (RR 0.81; 95% CI 0.71-0.92).⁵⁵ Specifically, among the programs that focused on enhancing patient self-care, heart failure hospitalizations decreased (RR 0.66; 95% CI 0.52-0.83) along with all-cause hospitalizations (RR 0.73; 95% CI 0.57-0.93). Additionally, strategies that employed telephone contact with advice to see their physician if exacerbation occurred reduced heart failure hospitalizations (RR 0.75; 95% CI 0.57-0.99) but not all-cause hospitalizations. A third systematic review of multidisciplinary team management for patients with heart failure found programs that included patient education and specialty follow-up were effective in reducing the risk of hospitalization (RR=0.77; 95% CI 0.68 to 0.86).⁶¹

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Other studies demonstrating the effectiveness of multidisciplinary team management on reducing avoidable rehospitalizations include the following:

- Multidisciplinary disease management plus home telehealth and a proactive review of care needs by disease management nurses for patients with cardiac disease or diabetes successfully reduced hospitalizations and ED utilization over 2 years of follow up. For patients with diabetes, hospitalizations and ED visits decreased by 51% and 17.5%, respectively, and for patients with cardiac disease, hospitalizations and ED use decreased by 5% and 50%, respectively.⁶²
- A multidisciplinary hip fracture service involving co-management by both the orthopedic and geriatric services, early discharge planning, and the transmission of detailed discharge instructions to the receiving care facility documented lower readmission rates than a national benchmark.⁵⁷
- A multidisciplinary, long-term, home-based intervention lowered rehospitalizations and costs when compared to usual care for patients with stroke, heart failure, acute coronary syndrome, and surgery.⁶³

Although multidisciplinary team management was shown to be effective in reducing hospitalizations in a number of studies, other studies reported similar multidisciplinary team management strategies with a trend toward reduced hospitalizations, but without reaching statistical significance.^{58,64}

4. Patient-Centered Care Planning at the End of Life

Numerous studies have documented the high utilization of health care resources in the last 6 months of life.^{65,66} Other studies have examined the low rates of referral and utilization for hospice and palliative care services during the last phase of life.^{67,68,69}

Recent studies investigated the impact of improved screening and referral for hospice care, when appropriate and desired. When patients desire and are referred for hospice services, hospitalization rates in the subsequent 30 to 180 days are decreased by 40% to 50%, as demonstrated by Casarett and Gonzalo.^{70,71} Casarett and colleagues trialed an intervention to improve screening of nursing home residents for appropriateness to hospice coupled with communicating this assessment to the patient's personal physician. The intervention group had significantly fewer acute care admissions over a 6-month period than usual care (0.28 vs. 0.49; $p=0.04$).⁷⁰ Similarly, Gonzalo and Miller found a significant effect of hospice enrollment on hospitalization use in the last 30 days of life (OR 0.47; 95% CI 0.45-0.50).⁷¹

Conclusions

Our survey of the published evidence revealed that the current body of published interventions to reduce rehospitalizations fall into four broad categories: 1) enhanced care and support during transitions; 2) improved patient education and self-management

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support; 3) multidisciplinary team management; and 4) patient-centered care planning at the end of life.

This survey of the published literature highlights the following:

1. There is a vibrant community of researchers and institutions endeavoring to identify successful strategies to reduce avoidable rehospitalizations.
2. Many of the interventions in the literature to date have focused on heart failure populations.
3. A variety of approaches seem to be promising, including close coordination of care in the post-acute period, early post-discharge follow-up, enhanced patient education and self-management training, proactive end-of-life counseling, and extending the resources and clinical expertise available to patients over time via multidisciplinary team management.
4. Improvement in reducing rehospitalizations is possible, although discerning the relative effect of any single intervention discussed in this document is not possible at this time.

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