Table 8 – Evidence for the Relationship between LRI Readmission and Quality of Care

Type of Evidence	Key Findings	Citation
Randomized Controlled Trial	Investigators examined the impact of implementing a 3-step critical pathway for CAP hospitalization on duration of intravenous antibiotic therapy, length of hospital stay, and 30-day readmission rates. The pathway involved early mobilization and criteria for switching to oral antibiotics and hospital discharge. 401 adults hospitalized with CAP in 2 tertiary hospitals in Barcelona, Spain were randomly assigned to receive either care with the 3-step critical pathway or standard care. While the 3-step critical pathway reduced intravenous antibiotic therapy duration and length of stay, it did not significantly change readmission rates (18% in intervention group vs. 15% in control group, p = 0.59).	Carratalà J, Garcia-Vidal C, Ortega L, Fernández-Sabé N, Clemente M, Albero G, López M, Castellsagué X, Dorca J, Verdaguer R, Martínez-Montauti J, Manresa F, Gudiol F. Effect of a 3-step critical pathway to reduce duration of intravenous antibiotic therapy and length of stay in community-acquired pneumonia: a randomized controlled trial. *Arch Intern Med*. 2012;172(12):922–928.[67]
Prospective & Retrospective Pre-Post Observational Study	Investigators analyzed implementation of a clinical pathway for treatment of infants hospitalized for acute viral bronchiolitis. The intervention consisted of specific management and discharge criteria. Eligible patients were <12 months old and admitted to a tertiary children's hospital in Australia. Data were retrospectively analyzed for 207 infants pre-pathway implementation and prospectively analyzed for 229 infants post-pathway implementation. There was a significant reduction in the 14-day readmission rate from pre- to	Cheney J, Barber S, Altamirano L, Medico Cirujano, Cheney M, Williams C, Jackson M, Yates P, O'Rourke P, Wainwright C. A clinical pathway for bronchiolitis is effective in reducing readmission rates. *J Pediatr*. 2005;147(5):622–626.[31]

	post-pathway implementation (7.2% vs. 0.9%, p = 0.001).	
Combined Prospective and Retrospective Cohort Study	Investigators analyzed the impact of implementing a clinical practice guideline (CPG) for bronchiolitis inpatient care on 7-day readmission rates. The practice guideline outlined scientific best practices described in the literature. Eligible patients were <12 months old and were hospitalized for bronchiolitis at 1 of 11 study hospitals. Administrative data were retrospectively analyzed for 846 patients treated pre-guideline implementation. Data for 792 patients were prospectively analyzed post-guideline implementation. Mean 7-day hospital readmission rates did not change significantly over the course of guideline implementation (1.7% to 1.9%, p = 0.84).	Kotagal UR, Robbins JM, Kini NM, Schoettker PJ, Atherton HD, Kirschbaum MS. Impact of a bronchiolitis guideline: a multisite demonstration project. *Chest*. 2002;121(6): 1789–1797.[68]
Retrospective Pre-Post Observational Study	Investigators evaluated the effects of implementing a literature-based diagnosis and management algorithm for the treatment of complicated pneumonia in children. Eligible patients were 3 months to 20 years old and were admitted to a tertiary children's hospital with a principal or secondary diagnosis code for empyema and/or pleural effusion from bacterial pneumonia. Clinical and billing data were analyzed for 83 children admitted 15 months pre-algorithm implementation and 87 children admitted 15 months post-algorithm implementation. There was a significant reduction in readmission rate from pre- to post-algorithm implementation	Pillai D, Song X, Pastor W, Ottolini M, Powell D, Wiedermann BL, DeBiasi RL. Implementation and impact of a consensus diagnostic and management algorithm for complicated pneumonia in children. *J Investig Med*. 2011;59(8):1221–1227.[32]

	(7.7% vs. 0%, p = 0.01).	
Retrospective Cohort Study	Investigators evaluated the impact of implementing a pneumonia guideline on 30-day readmission rates for patients hospitalized with pneumonia. The guideline outlined local best practices with recommendations from the American Thoracic Society and the Infectious Diseases Society of America. Eligible patients were ≥66 years old and were hospitalized for a definitive diagnosis of pneumonia. Utah Medicare and Medicaid data were collected for 17,728 patients hospitalized between 1993 and 2003. Hospitals in which the guideline was implemented had lower readmission rates than hospitals that did not implement the guideline (OR 0.86, p = 0.006).	Dean NC, Bateman KA, Donnelly SM, Silver MP, Snow GL, Hale D. Improved clinical outcomes with utilization of a community-acquired pneumonia guideline. *Chest*. 2006;130(3):794–799.[33]
Retrospective Cohort Study	Investigators studied the relationship between institutional CPGs for CAP and quality of care in children hospitalized with CAP. Eligible children were between 1 and 18 years old and were hospitalized with CAP. Patient data from 41 hospitals were obtained from the Pediatric Health Information System. Surveys were sent to participating hospitals to determine whether a CAP CPG was utilized. Investigators did not find a significant relationship between 14-day readmission rates and the presence of a CAP CPG (2.3% vs. 2.1%, p = 0.4).	Neuman MI, Hall M, Hersh AL, Brogan TV, Parikh K, Newland JG, Blaschke AJ, Williams DJ, Grijalva CG, Tyler A, Shah SS. Influence of hospital guidelines on management of children hospitalized with pneumonia. *Pediatrics*. 2012;130(5):e823–830.[69]
Retrospective Cohort Study	Investigators examined the impact of observation units for home oxygen therapy on hospital length of stay and readmission rates for bronchiolitis	Sandweiss DR, Mundorff MB, Hill T, Wolfe D, Greene T, Andrews S, Glasgow TS. Decreasing hospital length of stay for bronchiolitis by using an observation unit and

	hospitalizations. Eligible patients were 3 to 24 months old, had bronchiolitis not complicated by a serious bacterial infection, were tolerating nasal cannula oxygen (i.e., not requiring face mask or high-flow nasal cannula oxygen), and had hypoxia or an anticipated eventual need for oxygen supplementation. Administrative data were analyzed for 692 patients pre-implementation and 725 patients post-implementation in a single children's hospital in Utah. While the mean length of stay decreased significantly over the intervention period, readmission rates did not change.	home oxygen therapy. *JAMA Pediatr*. 2013;167(5):422–428.[70]
Retrospective Cohort Study	Investigators examined why some states have pneumonia readmission rates that are higher than the national average. Multivariate regression analyses were conducted using Medicare fee-for-service state-level data. The following variables were found to be associated with decreased 30-day readmission rates: (1) discharge information given to the patient and (2) recommended initial antibiotics used.	Schmeida M, Savrin RA. Pneumonia rehospitalization of the Medicare fee-for-service patient: a state-level analysis: exploring 30-day readmission factors. *Prof Case Manag*. 2012;17(3):126–131.[34]
Quality Improvement Study	Pediatric hospitalists formed a voluntary collaborative to benchmark resource utilization for bronchiolitis care. Resources were shared within the collaborative to establish benchmarks for resource utilization, and data on 11,568 hospitalizations at 17 different centers were analyzed during the 2-year intervention period.	Ralston S, Garber M, Narang S, Shen M, Pate B, Pope J, Lossius M, Croland T, Bennett J, Jewell J, Krugman S, Robbins E, Nazif J, Liewehr S, Miller A, Marks M, Pappas R, Pardue J, Quinonez R, Fine BR, Ryan M. Decreasing unnecessary utilization in acute bronchiolitis care: results from the value in inpatient pediatrics network. *J Hosp Med*. 2013;8(1):25–30.[71]

	Benchmarking for resource utilization did not cause a significant change in 3-day readmission rates. 3-day readmission rates did not vary significantly throughout the intervention and ranged from 1.2% to 1.7%.	

Table 9 – General Evidence for the Relationship between Readmission and Quality of Care

Type of Evidence	Key Findings	Citation
Readmission and Quality of Care Coordination, Discharge, and Care Transition Processes		
Meta-analysis	Investigators reviewed randomized controlled studies of structured telephone support or telemonitoring compared with standard practice for patients with congestive heart failure (CHF) in order to quantify the effects of these interventions as compared with standard care. Study participants were ≥18 years old and had a definitive diagnosis of CHF. The mean age of the participants ranged from 44.5 years to 78 years old. Eligible studies had readmission rates as the primary outcome. Of the eligible studies, 16 evaluated structured telephone support (5,613 patients), 11 evaluated telemonitoring (2,710 patients), and 2 tested both interventions. Structured telephone support (relative risk (RR) 0.77 [95% CI 0.68 to 0.87], p<0.0001) and telemonitoring (RR 0.79 [95% CI 0.67 to 0.94], p = 0.008) reduced chronic heart failure-related hospitalizations.	Inglis SC, Clark RA, McAlister FA, Ball J, Lewinter C, Cullington D, Stewart S, Cleland JG. Structured telephone support or telemonitoring programmes for patients with chronic heart failure. *Cochrane Database Syst Rev Online*. 2010;(8):CD007228.[44]
Meta-analysis	Investigators reviewed 18 studies with data from 8 countries to evaluate the effect of comprehensive discharge planning plus post-discharge support on readmission rates in	Phillips CO, Wright SM, Kern DE, Singa RM, Shepperd S, Rubin HR. Comprehensive discharge planning with postdischarge support for older patients with congestive heart failure: a meta-analysis. *JAMA*.

	patients with CHF. Eligible studies were English-language publications of randomized controlled clinical trials with detailed descriptions of interventions intended to modify hospital discharge for older inpatients. The mean age of participants in each study was ≥55 years old. Eligible studies specifically addressed CHF, described components for inpatient care plus post-discharge support, compared the effects with routine care, and reported readmission rates as the primary outcome. Patients with CHF who received comprehensive discharge planning plus post-discharge support had fewer readmissions than controls who received routine care (555/1,590 vs. 741/1,714; RR 0.75 [95% CI 0.64 to 0.88]).	2004;291(11):1358–1367.[45]
Meta-analysis	Investigators identified studies that assessed the effect of interventions for hospitalized patients on readmission rates. The search yielded 2,776 articles, including 378 systematic reviews, 7 of which were published after 2000 and served as key sources of data. Eligible studies were controlled trials or systematic reviews that reported data on interventions targeting adult hospitalized patients and measured readmission rates. The only 2 single-component strategies consistently associated with reduced readmissions were (1) intense self-management and transition coaching of patients at high risk of readmission and (2) the use of home visits or	Scott IA. Preventing the rebound: improving care transition in hospital discharge processes. *Aust Health Rev*. 2010;34(4):445–451.[46]

	telephone support for patients with heart failure. The meta-analysis suggested discharge processes are effective in reducing readmissions if they include the following components: (1) early assessment of discharge needs and medication reconciliation; (2) enhanced patient education; (3) early post-acute follow-up within 24 to 72 hours for high-risk patients; (4) early post-discharge nurse or pharmacist phone calls or home visits to confirm understanding of follow-up plans; and (5) appropriate referral for home care and community support services when needed.	
Meta-analysis	Investigators reviewed 24 randomized controlled trials that compared an individualized discharge plan with routine non-tailored discharge care. The study populations consisted of elderly hospitalized patients who had been admitted with a medical diagnosis. In the 12 trials that analyzed readmissions to the hospital within 3 months of discharge, patients who received discharge planning were readmitted at a reduced rate (RR 0.82 [95% CI 0.73 to 0.92]) compared with patients who received routine non-tailored discharge care.	Shepperd S, Lannin NA, Clemson LM, McCluskey A, Cameron ID, Barras SL. Discharge planning from hospital to home. *Cochrane Database Syst Rev Online*. 2013;1:CD000313.[47]
Meta-analysis	Investigators reviewed and re-analyzed data from 10 randomized controlled trials of heart failure care management programs to determine how program delivery methods contribute to patient outcomes. The 10 trials assessed the effect of chronic care management programs for heart failure patients discharged from a recent hospital	Sochalski J, Jaarsma T, Krumholz HM, Laramee A, McMurray JJV, Naylor MD, Rich MW, Riegel B, Stewart S. What works in chronic care management: the case of heart failure. *Health Aff (Millwood)*. 2009;28(1):179–189.[48]

	stay on readmission rates. Study participants were adult patients with heart failure who had recently been discharged from the hospital. Patients enrolled in chronic care management programs using a multi-disciplinary team approach had significantly fewer hospital readmissions than routine care patients and experienced a 2.9% reduction in readmissions per month. In-person communication rather than telephonic communication led to a significant reduction of 2.5% fewer readmissions per month.	
Randomized controlled trial	Investigators studied 121 patients with CHF to determine the effectiveness of a targeted inpatient CHF program in reducing readmission rates and cost. The program coupled patient education with comprehensive discharge planning and immediate outpatient reinforcement through a coordinated nurse-driven home health care program. Study participants were >50 years old, admitted to a single hospital site with a primary diagnosis of CHF, and able to participate in home health care after discharge. Members of the intervention group had a 6-month readmission rate of 11.4%, compared with 44.2% in the control group ($p = 0.01$). 30-day readmission rates were lower in the intervention group, as well (6.0% vs. 22.1% in the control group; $p = 0.01$).	Anderson C, Deepak BV, Amoateng-Adjepong Y, Zarich S. Benefits of comprehensive inpatient education and discharge planning combined with outpatient support in elderly patients with congestive heart failure. *Congest Heart Fail*. 2005;11(6):315–321.[49]
Randomized controlled trial	Investigators studied 122 patients at a single hospital to test the effectiveness of a low-cost	Balaban RB, Weissman JS, Samuel PA, Woolhandler S. Redefining and redesigning

	discharge intervention. The control group received the standard discharge protocol. The intervention group received: (1) a comprehensive, user-friendly patient discharge form; (2) electronic transfer of the patient discharge form to nurses at the primary care provider site; (3) telephone contact by a primary care nurse; and (4) primary care provider review and modification of the discharge-transfer plan. Participants had an established relationship with their PCP, defined as having had 2 or more visits with their PCP or 1 visit with their PCP and at least 2 RN contacts within the prior year. Only patients discharged to home were included in the analysis, and the average age of the patients in the intervention group was 58 years old. Four patients (8.5%) in the intervention group (n = 47) were readmitted within 31 days, compared with 14 patients (14.0%) in the historical control group (n = 100) (p = 0.34) and 4 patients (8.2%) in the concurrent control group (n = 49) (p = 0.96).	hospital discharge to enhance patient care: a randomized controlled study. *J Gen Intern Med*. 2008;23(8):1228–1233.[50]
Randomized controlled trial	Investigators identified 750 patients at the time of hospitalization and randomized them to receive routine care or a care transition intervention. The intervention consisted of: (1) tools to promote cross-site communication; (2) encouragement to take a more active role in self-care; and (3) continuity across settings and guidance from a transition coach. Readmission rates were measured at 30, 90, and 180 days. Eligible patients were ≥65 years	Coleman EA, Parry C, Chalmers S, Min S-J. The care transitions intervention: results of a randomized controlled trial. *Arch Intern Med*. 2006;166(17):1822–1828.[51]

	old, admitted to the participating delivery system's contract hospital during the study period for a non-psychiatric condition, and community dwelling (i.e., not from a long-term care facility). They had to reside within a predefined geographic radius of the hospital, have access to a working telephone, be English speaking, show no documentation of dementia in the medical record, and have no plans to enter hospice. Compared with control subjects, patients in the intervention group had lower readmission rates at 30 days (8.3% vs. 11.9%, p = 0.048) and at 90 days (16.7% vs. 22.5%, p = 0.04). Patients in the intervention group also had lower readmission rates for the same condition that precipitated the index hospitalization at 90 days (5.3% vs. 9.8%, p = 0.04) and at 180 days (8.6% vs. 13.9%, p = 0.046) than patients in the control group.	
Randomized controlled trial	Investigators performed a randomized controlled trial to evaluate the effectiveness of an early discharge planning protocol on reducing hospital readmission rates. The intervention was initiated on day 3 of the hospital stay for the experimental group (n = 417). Patients in the control group (n = 418) received service only upon referral by medical staff, which occurred on average on the ninth day of the hospital stay, with some patients not receiving the service at all. Eligible patients for the experimental group had been admitted to medical, neurologic, or surgical services at the VA Medical Center in Seattle, WA during a 21-month period. Forty-	Evans RL, Hendricks RD. Evaluating hospital discharge planning: a randomized clinical trial. *Med Care*. 1993;31(4):358–370.[52]

	four percent of patients in the experimental group and 47% of patients in the control group were ≥70 years old. Fewer patients in the experimental group were readmitted during the month post-discharge (24% vs. 35%, p<0.001). This trend toward fewer readmissions in the experimental group was also observed at 9 months (55% vs. 61%, p = 0.08), and the average length of stay during rehospitalization was significantly less for patients in the intervention group.	
Randomized controlled trial	Investigators randomized 749 hospitalized patients at a single institution to receive routine care or an intervention consisting of a nurse discharge advocate who worked with patients during their hospital stay to arrange follow-up appointments, confirm medication reconciliation, and provide patient education with an individualized instruction booklet that was also sent to the patient's primary care provider. A clinical pharmacist called the patients 2 to 4 days after discharge to reinforce the discharge plan and review medications. Eligible patients were English-speaking and ≥18 years old, had access to a telephone, and had plans to be discharged to a U.S. community. Patients in the intervention group (n = 370) had a lower rate of rehospitalization than those receiving routine care (n = 368) (0.314 vs. 0.451 visit per person per month; incidence rate ratio 0.695 [95% CI 0.515 to 0.937], p = 0.009). The intervention was most effective among participants who had been previously	Jack BW, Chetty VK, Anthony D, Greenwald JL, Sanchez GM, Johnson AE, Forsythe SR, O'Donnell JK, Paasche-Orlow MK, Manasseh C, Martin S, Culpepper L. A reengineered hospital discharge program to decrease rehospitalization: a randomized trial. *Ann Intern Med*. 2009;150(3):178–187.[53]

	hospitalized during the 6 months before the index admission (p = 0.014).	
Randomized controlled trial	Investigators studied 41 medical inpatients at a single hospital to determine the effectiveness of a supplemental care bundle implemented by hospital-based care coordinators and clinical pharmacists working with the study team. The intervention began within 24 hours of a patient's enrollment and continued up to 1 week after hospital discharge. Eligible patients were ≥70 years old, used 5 or more medications regularly, had 3 or more chronic comorbid conditions, required assistance in 1 or more activities of daily living, lived at home or in assisted living prior to admission, and had a reasonable expectation of returning to the same environment after discharge. Intervention group readmission rates and ED visit rates within 30 days were reduced compared with the control group (10.0% vs. 38.1%, p = 0.04). For those patients who had a readmission or a post-discharge ED visit, the time interval to this event was longer in the intervention group compared with routine care patients (36.2 vs. 15.7 days, p = 0.05).	Koehler BE, Richter KM, Youngblood L, Cohen BA, Prengler ID, Cheng D, Masica 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(4):211–218.[56]
Randomized controlled trial	Investigators studied 276 patients and 125 caregivers at a single site. Patients were randomized to receive either the hospital's routine discharge plan or the routine discharge plan plus a comprehensive, individualized discharge planning protocol developed specifically for elderly patients.	Naylor M, Brooten 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(12):999–1006.[55]

	Eligible patients were ≥70 years old with conditions falling into selected medical and surgical cardiac diagnostic-related groups (DRGs). During the initial 2-week period after discharge, 3 patients (4%) in the medical intervention group were readmitted, compared with 11 patients (16%) in the control group (p = 0.02). For the intervals 2 to 6 weeks and 6 to 12 weeks after discharge, the percentage of patients readmitted was similar for the intervention and control groups. Cumulatively, 10% of patients in the medical intervention group were readmitted during the first 6 weeks after discharge compared with 23% of control patients ([95% CI for the difference -25% to -1%], p = 0.04). Twelve weeks after discharge, 22% of the intervention group had been rehospitalized compared with 33% of the control group ([95% CI for the difference -26% to 4%], p = 0.15). The number of elderly patients rehospitalized in the medical control group was >3 times higher than that of the intervention group during the first 2 weeks after discharge. Six weeks after the initial hospital discharge, the readmission rate for the medical intervention group was 10%, well below nationally reported figures for comparable medical DRGs, suggesting that the intervention was most effective in delaying or preventing rehospitalizations during the first 6 weeks after the initial hospital discharge.	
Randomized controlled trial	Investigators studied 239 patients with heart failure at 6 sites to evaluate the effectiveness of a	Naylor MD, Brooten DA, Campbell RL, Maislin G, McCauley KM, Schwartz JS. Transitional care of

	transitional care intervention delivered by advanced practice nurses (APN). The intervention consisted of a 3-month APN-directed discharge planning and home follow-up protocol. Study participants were ≥65 years old. Time to first readmission or death was longer in intervention patients (log rank $X^2 = 5.0$, p = 0.026; Cox regression incidence density ratio = 1.65, [95% CI 1.13 to 2.40]). At 52 weeks, patients in the intervention group had fewer readmissions (104 vs. 162, p = 0.047).	older adults hospitalized with heart failure: a randomized, controlled trial. *J Am Geriatr Soc*. 2004;52(5):675–684.[54]
Randomized controlled trial	Investigators studied 282 patients with CHF at a single hospital to evaluate the effectiveness of a nurse-directed, multidisciplinary intervention on readmission rates within 90 days of hospital discharge. The intervention consisted of comprehensive education for the patient and family, a prescribed diet, social-service consultation and planning for an early discharge, a review of medications, and intensive follow-up. Eligible patients were ≥70 years old, had a confirmed diagnosis of CHF, and had at least 1 of the following risk factors for early readmission: prior history of heart failure, 4 or more hospitalizations for any reason in the preceding 5 years, or CHF precipitated by either an acute myocardial infarction or uncontrolled hypertension. Fifty-nine patients in the control group (42.1%) had at least 1 readmission during follow-up, as compared with 41 patients in the treatment group (28.9%; absolute reduction, 13.2%; [95% CI 2.1%	Rich MW, Beckham V, Wittenberg C, Leven CL, Freedland KE, Carney RM. A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure. *N Engl J Med*. 1995;333(18):1190–1195.[57]

	to 24.3%], p = 0.03). Multiple readmissions were less frequent in the treatment group (6.3% vs. 16.4% in the control group; 95% CI for the difference 2.8% to 17.4%; p = 0.01), such that the total number of readmissions during follow-up was reduced by 44.4% (p = 0.02).	
Prospective cohort study	Investigators conducted a prospective cohort study of parents surveyed using the care transitions measure, a survey that assesses components of discharge care to describe parental perceptions of a child's hospital discharge and assess the relationship between perceptions and hospital readmission. 348 parents were surveyed, comprising a 5% random sample of parents or legal guardians of 11,910 hospitalized patients who were discharged from the hospital between March and October 2010. Twenty-eight children (8.1%) experienced a readmission. Children whose parents strongly agreed (n = 206) with the statement "I felt that my child was healthy enough to leave the hospital" had a lower readmission rate than other children (4.4 vs. 11.3%, p = 0.004) and lower adjusted readmission likelihood (OR 0.2 [95% CI 0.1 to 0.6]).	Berry JG, Ziniel SI, Freeman L, Kaplan W, Antonelli R, Gay J, Coleman EA, Porter S, Goldmann D. Hospital readmission and parent perceptions of their child's hospital discharge. *Int J Qual Health Care*. 2013;25(5):573–581.[64]
Retrospective cohort study	Investigators conducted a retrospective cohort study to examine the relationships among hospital characteristics, discharge processes, and readmission. They used the 2008 CMS Hospital Quality Alliance dataset linked to the 2007 American Hospital Association annual survey.	Jha AK, Orav EJ, Epstein AM. Public reporting of discharge planning and rates of readmissions. *N Engl J Med*. 2009;361(27):2637–2645.[72]

	The study cohort consisted of enrollees in Medicare fee-for-service who had been readmitted within 30 days for CHF or pneumonia. The study found a weak correlation ($r = 0.05$, $p<0.001$) between performance on the 2 discharge measures: (1) the adequacy of documentation in the medical chart that discharge instructions were provided to patients with CHF and (2) patient-reported experiences with discharge planning. Larger hospitals performed better on the chart-based measure, while smaller hospitals and those with higher nurse-staffing levels performed better on the patient-reported measure. The study found no association between performance on the chart-based measure and readmission rates among patients with CHF (readmission rates among hospitals performing in the highest quartile vs. the lowest quartile, 23.7% vs. 23.5%; $p = 0.54$) and only a modest association between performance on the patient-reported measure and readmission rates for CHF (readmission rates among hospitals performing in the highest quartile vs. the lowest quartile, 22.4% vs. 24.7%; $p<0.001$) and pneumonia (17.5% vs. 19.5%, $p<0.001$).	
Retrospective cohort study	Investigators evaluated 48,538 patients who chose to participate in a telephonic intervention compared with patients who could not be reached by phone or declined to participate. Study participants were adult members of Medicare Advantage who had an acute inpatient	Costantino ME, Frey B, Hall B, Painter P. The influence of a postdischarge intervention on reducing hospital readmissions in a Medicare population. *Popul Heal Manag*. 2013;16(5):310–316.[58]

	hospitalization followed by discharge to home. Of the 48,538 Medicare members who received the intervention, 4,504 (9.3%) were readmitted to the hospital within 30 days, as compared with 5,598 controls (11.5%, p<0.0001). There was a direct correlation between the timing of the intervention and the rate of readmission: the closer the intervention to the date of discharge, the greater the reduction in number of readmissions.	
Retrospective cohort study	Investigators studied a state-wide intervention that provided transitional care to Medicaid beneficiaries after they had been discharged from the hospital. Patients in the intervention group received comprehensive medication management, face-to-face self-management education for patients and families, and timely outpatient follow-up with a medical home that had been fully informed about the hospitalization and any clinical or social issues that complicated the patient's care. The study cohort consisted of 13,476 Medicaid beneficiaries of any age who had multiple or catastrophic chronic conditions, had been discharged alive from an in-state general hospital with a qualifying DRG code during July 2010 to June 2011, and had enrolled in a Community Care of North Carolina primary care medical home at the time of discharge or within 30 days of discharge. Compared with clinically similar patients who received routine care, patients who received the intervention were 20% less likely	Jackson CT, Trygstad TK, Dewalt DA, Dubard CA. Transitional care cut hospital readmissions for North Carolina Medicaid patients with complex chronic conditions. *Health Aff (Millwood)*. 2013;32(8):1407–1415.[41]

	to be readmitted during the subsequent year and experienced a significantly longer time between their initial discharge and their first readmission. In addition, transitional care patients were significantly less likely than others to have second and third readmissions.	
Retrospective cohort study	Investigators studied 818 patients at a single hospital to evaluate the effect of acute care for elders (ACE) units on readmission as compared with usual care. ACE units use an interdisciplinary team model to provide hospital care, in contrast with a multidisciplinary model used by the usual care unit in which providers from all disciplines deliver care but practice predominantly independently. Eligible patients were ≥70 years old, met inpatient admission criteria, and had spent their entire hospitalization in either the acute care for elders (ACE) unit or the usual care unit. Patients in the ACE unit experienced fewer readmissions within 30 days of discharge than those in the usual care unit (7.9% vs. 12.8%; p = 0.02).	Flood KL, Maclennan PA, McGrew D, Green D, Dodd C, Brown CJ. Effects of an acute care for elders unit on costs and 30-day readmissions. *JAMA Intern Med*. 2013:1–7.[59]
Retrospective cohort study	Investigators studied 30,272 patients enrolled in a chronic disease management program who had a hospital admission for any reason during 2008. Those who received a telephone call within 14 days of discharge and were not readmitted prior to that call comprised the intervention group. All other enrollees formed the comparison group. Study participants were adult members of a large commercial health plan with Medicare	Harrison PL, Hara PA, Pope JE, Young MC, Rula EY. The impact of postdischarge telephonic follow-up on hospital readmissions. *Popul Heal Manag*. 2011;14(1):27–32.[62]

	Advantage. Receipt of a discharge call was associated with reduced rates of readmission: intervention group members were 23.1% less likely than the comparison group to be readmitted within 30 days of hospital discharge (p = 0.043).	
Retrospective cohort study	Investigators studied the effect of a post-discharge follow-up visit on readmission in patients with sickle cell disease (SCD). Study participants consisted of adults and children enrolled in Wisconsin Medicaid between January 2003 and December 2007. Classification of SCD was based on disease-specific ICD-9-CM codes. Patients had to have an inpatient hospitalization with a discharge diagnosis of SCD or 2 outpatient visits at least 30 days apart with a diagnosis of SCD. Patients who had post-discharge follow-up within 30 days of hospital discharge were readmitted less often than those who did not. Fifteen (9.87%) of the 152 patients with at least 1 outpatient visit (within 30 days or prior to a rehospitalization) were rehospitalized compared with 55 (21.5%) of the 256 without an outpatient visit (p<0.01).	Leschke J, Panepinto JA, Nimmer M, Hoffmann RG, Yan K, Brousseau DC. Outpatient follow-up and rehospitalizations for sickle cell disease patients. *Pediatr Blood Cancer*. 2012;58(3):406–409.[60]
Survey study	Investigators performed a cross-sectional study using a web-based survey of hospitals to examine their reported use of specific strategies intended to reduce readmissions for patients with heart failure. Eligible hospitals were enrolled in either the Hospital to Home National Quality Improvement Initiative or the State Action on Avoidable Rehospitalizations Initiative. Of the 658 eligible	Bradley EH, Curry L, Horwitz LI, Sipsma H, Wang Y, Walsh MN, Goldmann D, White N, Piña IL, Krumholz HM. Hospital strategies associated with 30-day readmission rates for patients with heart failure. *Circ Cardiovasc Qual Outcomes*. 2013;6(4):444–450.[61]

	hospitals, 599 completed the survey. After adjusting for hospital teaching status, geographic location, and number of staffed beds, the investigators found that the following strategies were associated with lower 30-day hospital readmission rates: (1) partnering with community physicians or physician groups to reduce readmission; (2) partnering with local hospitals to reduce readmissions; (3) having nurses responsible for medication reconciliation; (4) arranging follow-up appointments before discharge; (5) having a process in place to send all discharge paper or electronic summaries directly to the patient's primary physician; and (6) assigning staff to follow up on test results that return after the patient is discharged. Hospitals that implemented more strategies had significantly lower 30-day readmission rates than those that implemented only 1 strategy.	
Readmission and Quality of Disease Management		
Case-control study	Investigators assessed the relationship between readmission risk and quality of care via chart review using condition-specific criteria for the admission work-up, evaluation and treatment, and discharge readiness. Study participants were adult male patients with diabetes, heart failure, or obstructive lung disease hospitalized at 12 VA hospitals in the southern United States between October 1, 1987 and September 30, 1989. Lower quality of inpatient care was associated with a higher risk of unplanned readmission within	Ashton CM, Kuykendall DH, Johnson ML, Wray NP, Wu L. The association between the quality of inpatient care and early readmission. *Ann Intern Med*. 1995;122(6):415–421.[73]

	14 days. Roughly 1 in 7 unplanned early readmissions in patients with diabetes, 1 in 5 in patients with heart failure, and 1 in 12 in patients with obstructive lung disease were attributable to substandard inpatient care after other explanatory variables were taken into account.	
Prospective pre-post observational study	Investigators developed an asthma care process model (CPM) with the primary goal of standardizing asthma care and improving quality and examined its effect on readmission. The model incorporated the 3 Children's Asthma Care measures (CAC-1, -2, and -3) recommended by the Joint Commission to improve the quality of pediatric inpatient asthma care. The measures require the following elements: (1) use of beta-agonists; (2) use of systemic corticosteroids; and (3) provision of a home management plan that includes documentation of a follow-up appointment, environmental or other trigger control, a written action plan, and reliever and controller medications. Study participants were 1,865 children between the ages of 2 and 17 years old at a freestanding children's hospital. Increased compliance with the CAC measures was associated with a sustained decrease in readmissions. 6-month asthma readmission rates declined from an average of 17% to 12% ($p<0.01$) post-implementation.	Fassl BA, Nkoy FL, Stone BL, Srivastava R, Simon TD, Uchida DA, Koopmeiners K, Greene T, Cook LJ, Maloney CG. The Joint Commission Children's Asthma Care quality measures and asthma readmissions. *Pediatrics*. 2012;130(3):482–491.[74]
Retrospective cohort study	Using data from the 2009-2010 IMS LifeLink dataset, investigators studied the relationship between quality of care processes and readmission.	Chen JY, Ma Q, Chen H, Yermilov I. New bundled world: quality of care and readmission in diabetes patients. *J Diabetes Sci Technol*. 2012;6(3):563–571.[75]

	Study participants were 30,139 commercially-insured patients with diabetes who were ≥19 years old. Patients who received at least 1 LDL test (OR 0.918 [95% CI 0.852- to 0.989], p<0.025) and a ≥90-day supply of statins (OR 0.91 [95% CI 0.85 to 0.97], p<0.01) had lower readmission rates than those who did not receive such care.	
Retrospective cohort study	Investigators evaluated the relationship between adherence to recommendations for surgical care and various clinical outcomes. They used the Premier Perspective database, which included data from 312 hospitals and contained standard hospital discharge data, plus a date-stamped record of all material and medication charges during the hospitalization. Adherence to evidence-based processes of surgical care was measured in terms of use of appropriate peri-operative antibiotic prophylaxis, beta-blockade, and venous thromboembolism prophylaxis. The patient outcomes evaluated were mortality, length of stay (LOS), discharge disposition, surgical complications, readmissions, and reoperations within 30 days of discharge. Eligible patients were ≥18 years old, admitted between October 1, 2003 and September 30, 2005, and underwent primary hip or knee arthroscopy Lack of adherence to surgical processes of care was associated with increased risk of readmission (OR 1.25 [95% CI 1.13 to 1.37]) for 2 or 3 missed processes, compared with no missed processes).	Bozic KJ, Maselli J, Pekow PS, Lindenauer PK, Vail TP, Auerbach AD. The influence of procedure volumes and standardization of care on quality and efficiency in total joint replacement surgery. *J Bone Joint Surg Am*. 2010;92(16):2643–2652.[76]

Retrospective cohort study	Investigators assessed the relationship between appropriateness of readmission and previous hospital stay using the InterQual admission and discharge standards, which are based on clinical indicators, service requirements, and discharge readiness. They used the Department of Veterans Affairs Patient Treatment File and medical records. Of the 694 adult medical and surgical patients who were readmitted to a VA Medical Center within 2 weeks of discharge during the fiscal year 1984, 445 met eligibility criteria (available medical records and information on previous admission) for analysis. Forty-six percent (207/445) of the patients readmitted within 2 weeks of prior hospitalization had an inappropriate readmission, and 40% (178/445) had an inappropriate previous admission. Four percent (13/311) of readmitted patients had an inappropriate admission, discharge, and readmission. Appropriateness of the previous admission, previous discharge, and readmission were significantly associated.	Ludke RL, MacDowell NM, Booth BM, Hunter SA. Appropriateness of admissions and discharges among readmitted patients. *Health Serv Res*. 1990;25(3):501–525.[77]
Retrospective cohort study	Investigators conducted a retrospective cohort study to determine whether readmission rates after major surgery vary across hospitals and whether these rates are related to other markers of surgical care quality. They used the 2009 Medicare Inpatient dataset, the 2010 Medicare Provider Analysis and Review File, and the American Hospital Association annual survey on hospital characteristics.	Tsai TC, Joynt KE, Orav EJ, Gawande AA, Jha AK. Variation in surgical-readmission rates and quality of hospital care. *N Engl J Med*. 2013;369(12):1134–1142.[78]

	The study cohort consisted of 479,471 Medicare beneficiaries who had undergone any of the following surgical procedures in 2009: coronary-artery bypass grafting, pulmonary lobectomy, endovascular repair of abdominal aortic aneurysm, colectomy, and hip replacement. Hospitals with high surgical volume and low surgical mortality have lower rates of surgical readmission than other hospitals. Hospitals in the highest quartile for surgical volume had a significantly lower composite readmission rate than hospitals in the lowest quartile (12.7% vs. 16.8%, $p<0.001$), and hospitals with the lowest surgical mortality rates had a significantly lower readmission rate than hospitals with the highest mortality rates (13.3% vs. 14.2%, $p<0.001$).	