Reducing Hospital Readmissions in New York State: A Simulation Analysis of Alternative Payment Incentives

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Contents

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Executive Summary

Hospital readmissions are widely recognized as an important source of avoidable health care costs and a potential marker for unacceptable levels of hospital acquired infections, premature discharge, failure to reconcile medications, inadequate communication with patients and community providers responsible for post-discharge care, or poor transitional care. While not all readmissions result from problems with patient care or management, strong evidence exists that some specific interventions at the time of discharge can reduce readmissions for certain conditions.

Confronting the urgent need to address health costs, some states have begun to focus specifically on such interventions—including adherence to condition-specific protocols shown to reduce readmissions, restructuring hospital and post-hospital discharge planning, and use of standardized discharge forms to improve communication across care settings. Similarly, some integrated delivery systems and multi-stakeholder collaboratives have begun to invest in programs to provide discharged patients with information and advice in order to prevent problems that might lead to readmissions. However, emerging efforts to reduce readmissions largely focus on payment incentives.

In this study, we investigate two such incentives: pay-for-performance (P4P) and episode-based payments. The P4P strategy we consider is similar to the New York Medicaid program's current P4P system and also similar to the P4P strategy Medicare will develop as required by the Patient Protection and Affordable Care Act. The episode-based payment strategy we consider is similar to a planned Medicare pilot program, bundling payments for hospital and post-acute physician services to encourage more effective coordination of services and prevent avoidable readmissions.

READMISSIONS IN NEW YORK COST NEARLY $4 BILLION PER YEAR.

In 2008, nearly 15% of all initial (or index) hospital stays in New York resulted in a readmission within 30 days. These readmissions (nearly 274,000 hospital stays in 2008) cost $3.7 billion, accounting for 16% of total hospital costs (Table ES.1). Readmissions for complications or infections cost $1.3 billion, accounting for nearly 6% of total hospital costs.

TABLE ES.1. Hospital Readmission Rates and the Cost of Readmissions, 2008

	TOTAL (THOUSANDS)	READMISSION RATE	PERCENTAGE OF READMISSIONS	TOTAL PAYMENTS ($ BILLIONS)	PERCENTAGE OF PAYMENTS FOR READMISSIONS	PERCENTAGE OF TOTAL HOSPITAL PAYMENTS
All admissions	2,087.1	n/a	n/a	$23.4	n/a	100.0%
All index admissions	1,872.6	n/a	n/a	$19.9	n/a	85.2%
ALL READMISSIONS						
For any reason within 30 days	273.6	14.6%	100.0%	$3.7	100.0%	16.0%
For complications or infections within 30 days	72.7	3.9%	26.6%	$1.3	34.5%	5.5%

SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

Patients aged 65 or older accounted for more than half of all readmissions and readmission costs in New York State in 2008. The rate and cost of readmissions were highest for Medicare and Medicaid, but readmissions were a source of significant cost for private payers as well.

READMISSION RATES VARY WIDELY, EVEN ADJUSTED FOR CASE MIX.

Individual hospitals' readmission rates varied substantially in 2008. Nine percent of hospitals had unadjusted readmission rates that were at least 50% above the statewide average. Even adjusted for hospital case mix (that is, the prevalence of more severely ill patients), hospital experience varied. Six percent of hospitals had actual readmission rates that were at least three percentage points above their expected rates.

IMPROVING DISCHARGE PROCESSES AND POST-DISCHARGE SUPPORT CAN REDUCE HOSPITAL READMISSIONS BY ONE-THIRD.

At least four factors are widely viewed as important to effective discharge planning: (1) coordination between the hospital-based and primary care physicians, (2) better communication between the hospital-based physician and the patient, (3) better education and support for patients to manage their own conditions, and (4) reconciliation of medications at discharge or immediately afterward. While many of the most promising interventions for lowering readmission rates address some or all of these factors, few have been rigorously evaluated using randomized controlled trials.

Two interventions that have been rigorously evaluated and found effective are the Care Transitions Intervention (CTI) and Project Re-Engineered Discharge (RED). Both interventions engage specially trained nurse advocates who help patients navigate the discharge process, educating and coaching the patient to manage his or her disease after discharge. Both also include a formal reconciliation of medications following discharge. However, despite strong evidence that both interventions can reduce 30-day all-cause readmissions by 30 to 35%, relatively few hospitals have adopted these programs.

WHEN CONSIDERING INTERVENTIONS TO REDUCE READMISSIONS, HOSPITALS BALANCE COSTS AND BENEFITS.

When hospitals are paid fee-for-service (FFS), each admission or day they provide care represents additional revenue. A hospital that is not paid more when it reduces the probability of readmissions loses revenue when it readmits fewer patients: each readmission the hospital avoids represents lost revenue. As a result, it is unsurprising that hospitals might be reluctant to adopt an intervention to reduce readmissions when they are paid FFS, even when the intervention is proven to be effective.

Increasingly, Federal and state policymakers are looking to payment incentives to re-align hospital incentives to improve quality on various metrics, including their rates of readmission. When deciding how to respond to payment incentives, a revenue-maximizing hospital

would compare the direct and indirect costs with the financial benefit of reducing its rate of readmission. Payment reform aims to tip the scale by increasing the financial benefit to hospitals that reduce their readmission rates; however, little analysis has been done to determine how effective different payment reforms might be.

The two payment reforms considered in this study—P4P and episode-based payments—represent the two ends of a continuum of payment approaches designed to reduce the perverse incentives of FFS payment that encourage readmissions. The versions of P4P and episode-based payment we selected are clearly different from one another, but either could be modified in ways that would make them more similar (for example, by integrating shared savings between the payers and hospitals).

The P4P approach that we consider is similar to that recently adopted by New York's Medicaid program, and potentially like that which Medicare will implement soon. P4P continues to provide FFS payments for each readmission, but adds an incentive for hospitals with more readmissions than would be expected (given their case mix) to work at lowering their readmission rates. With P4P, payers can easily recoup savings: not only do they benefit from reduced readmissions (resulting in reduced payments), but they pay hospitals with high rates of readmission less per admission.

In contrast, episode-based payments (which Medicare has piloted but currently does not plan to adopt more widely) would replace fee-for-service payment entirely. Each hospital would be paid more for an index stay by an amount equal to its expected cost of readmissions, adjusted to its case mix. Episode-based payments would provide an incentive for *every* hospital to reduce its readmission rate by, in effect, putting the hospital at financial risk for each readmission. However, because hospitals would retain the savings associated with reduced readmissions, payers would benefit only as payments are benchmarked to lower readmission rates over time.

PAYMENT INCENTIVES CAN REDUCE READMISSIONS AND COSTS.

Based on a simulation of hospital responses to P4P and episode-based payments, we estimated that either would result in reduced readmissions and lower total hospital payments. However, both the magnitude of the response and the expected short-term cost savings would vary, depending on the payment incentive.

Specifically, when confronted with P4P incentives, most hospitals would face no payment reduction; and among the hospitals that would face a payment reduction, only some would act to reduce readmissions. We estimate that 7% of hospitals in New York would respond to P4P by implementing an intervention known to reduce readmissions (CTI or Project RED), resulting in 1,200 to 2,000 fewer readmissions per year (a reduction of 0.5 to 1%). In contrast, hospitals would be uniformly more responsive to episode-based payments. We estimate that at least half of hospitals (and as many as 82%) would implement either clinical intervention, resulting in 19,000 to 45,000 fewer readmissions per year (a reduction of 7 to 16%).

Reducing the number of readmissions generates cost savings—but the savings to payers depend on the type of payment incentive. When hospitals are paid FFS, payers always capture the cost savings from fewer readmissions. While the P4P incentives we modeled would induce less change in hospital behavior than episode-based payments, payers would capture most of the cost savings. As a result, simulated total payments to hospitals (for all admissions) would fall by about $200 million (1%) (Table ES.2).

With episode-based payments, many more hospitals would respond and, therefore, readmissions would fall more than they have under P4P; however, because the hospitals would be paid their risk-adjusted expected cost of readmissions (reflecting recent past performance statewide), the reduction in total payments would lag behind the reduction in readmissions. Under episode-based payments, simulated total payments would fall $188 to $286 million (0.8 to 1.2%). Payers would save more over time as they rebased episode-based payments to reflect lower rates of readmission, but in the short term, hospitals would retain most of the savings—and, therefore, have an incentive to further reduce readmissions.

TABLE ES.2. Simulated Payment Reform Effects on Hospital Payments, 2008

	TOTAL PAYMENTS FOR ALL ADMISSIONS ($ BILLIONS)	SIMULATED CHANGE IN TOTAL PAYMENTS	
		DOLLARS ($ MILLIONS)	PERCENTAGE CHANGE
Actual experience	$23.4	n/a	n/a
Pay for performance			
ALL HOSPITALS THAT RESPOND IMPLEMENT:			
CTI	$23.2	-$200.3	-0.9%
Project RED	$23.2	-$205.3	-0.9%
Episode-based payments			
ALL HOSPITALS THAT RESPOND IMPLEMENT:			
CTI	$23.2	-$187.5	-0.8%
Project RED	$23.1	-$285.5	-1.2%

SOURCE: Mathematica Policy Research analysis of New York hospital discharge data.

DIRECT PAYMENT FOR EVIDENCE-BASED DISCHARGE PROCESSES AND POST-DISCHARGE SUPPORT COULD BE MORE EFFECTIVE.

Under either payment incentives that we modeled, cost savings were less than would have occurred had more hospitals been induced to adopt CTI or Project RED, or had payers been able to retrieve all of the savings from reduced readmissions immediately. Payers might achieve both greater change and immediate savings simply by paying hospitals directly to implement evidence-based interventions. For example, we estimate that New York Medicaid might have spent $19.9 million to implement Project RED in all hospitals to achieve a net savings of $116 million. If Medicare had paid directly for evidence-based interventions to reduce readmissions,

it might have achieved even larger net savings: $427 million by paying for the Project RED in all New York hospitals. In the aggregate, commercial payers' savings would have been smaller, but comparable to Medicaid's and still substantial.

Diverting from payment incentives to direct payment for reducing hospital readmissions would be a significant step, especially in light of the P4P program that New York's Medicaid program already has implemented. However, the prospect of both greater reduction in readmissions and greater payer savings from direct payment to hospitals to adopt evidence-based discharge procedures raises important questions about whether payers should instead rely on payment incentives for that purpose. This study demonstrates the need for greater clarity and discussion among payers and hospitals about how best to achieve the changes that are needed to reduce readmissions in New York.

Introduction

Hospital readmissions are widely recognized as an important source of avoidable health care costs, as well as a potential marker for problems that reduce the quality of care.[1] High rates of hospital readmissions can indicate unacceptable levels of hospital-acquired infections, premature discharge, failure to reconcile medications, inadequate communication with patients and community providers responsible for post-discharge care, or poor transitional care. Indeed, appropriate coordination and planning for follow-up care that should begin in the hospital appears often to be lacking: one study found that a large percentage of readmitted patients had not seen a physician after their initial discharge (Jencks *et al.* 2009).

Early initiatives to reduce readmissions started with simply educating providers and consumers about the prevalence of readmissions, and many continue to rely on this method. For example, Medicare Quality Improvement Organizations use data on readmissions to provide feedback to hospitals about their own performance. In addition, CMS hosts a Medicare Compare website to help consumers make more informed choices when selecting a hospital for inpatient care. Medicare Compare offers hospital-specific information comparing 30-day Medicare readmissions for three conditions (heart attacks, heart failure, and pneumonia).[2] At least eight states (including New York) have data systems comparing hospitals on potentially preventable readmissions (3-M Health Information Systems 2011).[3] The Accountable Care Act (ACA) requires the Department of Health and Human Services also to collect data on readmission rates in order to calculate and publicly report each hospital's readmission rate.

While not all readmissions result from problems with patient care or management, there is strong research evidence that some specific interventions at the time of discharge can reduce readmissions for certain conditions (Gwadry-Sridhar *et al.* 2004, Phillips *et al.* 2004). Confronting the urgent need to address health costs, some states have begun to focus specifically on such interventions—including adherence to condition-specific protocols shown to reduce readmissions, restructuring hospital and post-hospital discharge planning, and use of standardized discharge forms to improve communication across care settings.[4]

[1] Nationally, and in selected states where studies of readmissions have been conducted, both the rates and cost of readmission are significant. For example, nearly one-fifth (19.1%) of Medicare patients discharged from the hospital are readmitted within 30 days, costing Medicare an estimated $15 to $18 billion per year (CMS 2011; Jencks *et al.* 2009; MedPAC 2007). A long running study in Pennsylvania across all payers found that nearly 20% of patients admitted for any of several common procedures or diagnoses in 2007 were readmitted within 30 days of discharge. Data from Maryland hospitals for 2007 found that approximately 10% of patients were readmitted within 30 days, costing an estimated $657 million per year, or 8% of total inpatient charges (MHSCRC 2011).

[2] For each condition, Medicare Compare reports each hospital's case-mix-adjusted readmission rate to the national average.

[3] The system developed by 3M Health information Systems is most commonly used to measure potentially preventable hospital readmissions. A description of the systems in place in various states is available at http://www.tmhp.com/Workshop_Materials/Potentially%20Preventable%20Readmissions%20(PPR)%20Reports/Texas%20PPR%20Methodolgy%20Overview.pdf, accessed April 22, 2011.

[4] For example, State Action on Avoidable Rehospitalizations (STAAR) is working with four states (Massachusetts, Michigan, Ohio, and Washington) to help reduce rehospitalizations. STAAR attempts to engage payers, state and national stakeholders, patients and their families, and caregivers to improve care coordination before and following discharge (see: http://staar.posterous.com/archive/7/2010, accessed May 22, 2011).

Similarly, some integrated delivery systems or multi-stakeholder collaboratives have begun to invest in programs to provide discharged patients with information and advice to prevent problems that might lead to readmissions. For example, some pay specially trained nurses or pharmacists to follow up by telephone to confirm that the patients or caregivers received discharge instructions, the patient did not receive duplicate or contraindicated prescriptions, and that patients or caregivers understand what they need to do (such as physician follow-up visits) to prevent future problems or complications (Pittsburgh Regional Health Initiative 2011; Lake, Stewart, and Ginsburg 2011; Boutwell and Hwu 2009). Two prominent approaches used in many of these efforts, the Care Transitions Intervention and Project Re-Engineered Discharge (Coleman *et al*. 2006; Jack *et al*. 2009), are discussed in detail in Chapter 3 of this report.

Seeking to expand hospitals' efforts to reduce preventable readmissions, both public and private payers increasingly are turning to the use of financial incentives—using measures of preventable or all-cause readmissions to select a hospital network, give preferred status in a network, or determine payment levels. For example, in New York, the Medicaid program reduces payment to hospitals with a potentially preventable readmission rate higher than a statewide risk-adjusted benchmark for all admissions in the following year.[5] In Maryland (the only state with an all-payer system for establishing hospital payment rates), planning to incorporate P4P incentives in all-payer hospital rates is underway in an effort to reduce rates of potentially preventable readmissions (Feeney 2011). Under the Accountable Care Act (ACA), Medicare also will adjust payment to hospitals with relatively high rates of readmissions for selected high-volume or high-expenditure conditions, effective October 1, 2012. As set out in proposed regulations, the readmissions reduction program initially will target acute myocardial infarction (heart attack), heart failure, and pneumonia.[6]

Designing appropriate payment incentives to reduce readmissions raises important questions related both to the potential effectiveness of payment incentives and to their unintended consequences. For example, few hospitals may respond to payment incentives if the magnitude of incentives is insufficient. Some—including those that disproportionately serve disadvantaged populations—may not have the financial or staff resources to respond. In either case, payment incentives might produce less change that is desired and, further, might worsen the financial condition of hospitals that serve disadvantaged populations (Bhalla and Kalkut 2010).

This study investigates the potential for two alternative types of payment incentives to reduce rates of readmission in New York acute-care hospitals. Microsimulation analysis is used to estimate whether a revenue-maximizing hospital would respond to, respectively, a conventional P4P payment system or episode-based payments by adopting either of two specific

[5] The State's public health law requires that rates of payment for inpatient services be reduced such that net Medicaid payments statewide fall at least $35 million for the period July 1, 2010 through March 31, 2011, and at least $47 million the next year (April 1, 2011 through March 31, 2012).

[6] The proposed methodology and criteria to be used in implementing changes to the Medicare hospital inpatient prospective payment regulations were issued on April 19, 2010. The definition of "applicable hospital" and the adjustment factor by which payments will be reduced will be addressed in the proposed rules for FY 2013 (CMS 2010).

evidence-based interventions to improve discharge procedures and follow-up with patients after discharge. In order to calculate the maximum potential effectiveness of such payment incentives, we assume that all payers—Medicare, Medicaid, and private insurance and employer plans—simultaneously adopt the same system of payment incentives.

The rest of this report is organized as follows. In Chapter 2, estimates of hospital readmission rates in 2008 are presented for all payers, measured from New York's hospital discharge data. Chapter 3 includes a review of the research literature on hospital interventions to reduce readmissions, explaining the rationale for selecting two specific evidence-based interventions for the purpose of this study. In Chapter 4, we present the logic of a revenue-maximizing hospital's business case for acting to reduce readmissions in response to either P4P or episode-based payments. We also present estimates of hospital cost for each of the two evidence-based interventions considered in this study. In Chapter 5, the results of the simulation analysis are presented—including the number and proportion of hospitals that implement either intervention in response to payment incentives, the change in the number and rate of readmissions, and changes in the total cost of inpatient care. Chapter 5 concludes with an additional analysis investigating the net change in payments for inpatient hospital care that might occur if payers directly funded interventions to reduce hospital readmission, rather than relying on payment incentives.

Hospital Readmissions in New York State

Readmissions are common in New York hospitals, and they are costly. In 2008, nearly 15% of initial (or index) hospital stays in New York resulted in a readmission within 30 days (Table II.1). The cost of these readmissions totaled $3.7 billion, or about 16% of total hospital costs that year.[7]

TABLE II.1.
Hospital Readmission Rates and the Cost of Readmissions, 2008

	TOTAL	READMISSION RATE	TOTAL PAYMENTS ($ MILLIONS)	PERCENTAGE OF TOTAL HOSPITAL PAYMENTS
All admissions	2,087,087	n/a	$23,391.1	100.0%
All index admissions	1,872,564	100.0%	$19,925.2	85.2%
INDEX ADMISSIONS FOLLOWED BY A READMISSION WITHIN 30 DAYS				
For any reason	273,575	14.6%	$3,744.0	16.0%
For complications or infections	72,656	3.9%	$1,290.6	5.5%
INDEX ADMISSIONS FOLLOWED BY A READMISSION WITHIN 14 DAYS				
For any reason	175,766	9.4%	$2,461.6	10.5%
For complications or infections	48,079	2.6%	$867.4	3.7%

SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

NOTE: Readmission rates are calculated as the percentage of index admissions followed by a readmission within 30 or 14 days. Readmission rates and costs were calculated for admissions that occurred between January and October 2008 (reported through December 2008) and then annualized. The cost of readmissions is estimated as the charge for readmissions multiplied by the hospital's 2008 total cost-to-charge ratio.

More than one-fourth of readmissions in 2008 (equal to nearly 4% of hospital stays) were for complications or infections. On average, these readmissions were disproportionately expensive—costing nearly $1.3 billion or 5.5% of total hospital costs in 2008.

Not all hospital stays are equally likely to be followed by a readmission. In 2008, most index stays in New York were for medical treatment (versus surgery, behavioral health care, or maternity care). Nearly 18% of medical stays resulted in a readmission, accounting for 67% of all readmissions and 69% of all readmission costs ($2.6 billion) (Table II.2).[8] Nearly 19% of all readmissions were for complications or infections following a medical stay; these readmissions were disproportionately costly, accounting for 24% of all readmission costs ($913 million).

[7] Only "index admissions" are used to determine the proportion of stays that result in a readmission. Index admissions exclude stays where the patient died, transferred to another health care facility, left against medical advice, or received treatment for a condition expected to result in a subsequent readmission, such as obstetrical care prior to labor and delivery or treatment for a metastatic cancer. Greater detail describing how index admissions were defined is provided in the technical appendix to this report.

[8] All admissions that did not involve surgery, labor and delivery, or mental health or substance abuse treatment were categorized as medical stays.

TABLE II.2. Number and Cost of 30-Day Readmissions by Type of Stay, 2008

	NUMBER OF READMISSIONS	READMISSION RATE	PERCENTAGE OF TOTAL READMISSIONS	PAYMENTS FOR READMISSIONS ($ MILLIONS)	PERCENTAGE OF TOTAL READMISSION COSTS
READMISSIONS FOR ANY REASON WITHIN 30 DAYS					
Number of readmissions	273,575	14.6%	100.0%	$3,744.0	100.0%
TYPE OF INDEX ADMISSION:					
Medical	182,839	17.9%	66.8%	$2,568.6	68.6%
Surgical	52,466	11.8%	19.2%	$771.8	20.6%
Behavioral health	33,026	21.5%	12.1%	$372.1	9.9%
Maternity	5,243	2.1%	1.9%	$31.4	0.8%
READMISSIONS FOR COMPLICATIONS OR INFECTIONS WITHIN 30 DAYS					
Number of readmissions	72,656	3.9%	26.6%	$1,290.6	34.5%
TYPE OF INDEX ADMISSION:					
Medical	50,590	4.9%	18.5%	$913.4	24.4%
Surgical	21,043	4.7%	7.7%	$362.9	9.7%
Behavioral health	930	0.6%	0.3%	$13.5	0.4%
Maternity	94	0.0%	0.0%	$0.8	0.0%

SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

NOTE: See Table II.1.

Surgical stays were less likely than medical stays to be followed by a readmission. In 2008, nearly 12% of surgical index stays resulted in a readmission within 30 days, accounting for 19% of all readmissions and nearly 21% ($772 million) in total payments for readmissions. However, more than 40% of readmissions following a surgical index stay were due to complications or infections, a much higher proportion than for any other admission type. Though less than 5% of all readmissions, these readmissions were disproportionately expensive (similar to readmissions for complications or infections following a medical stay), accounting for nearly 10% of all readmission costs ($363 million) in 2008.

Index stays for behavioral health were the most likely to be followed by readmission. More than 21% of patients initially admitted for a behavioral health diagnosis were readmitted within 30 days. However, because behavioral health stays were less common in the first place (accounting for less than 10% of all stays), readmissions following a behavioral health accounted for a relatively low share of all readmissions (12%) and a still lower share of readmission costs (10%, or $372 million).

Admissions for labor and delivery were the least likely to be followed by a readmission. Just 2% of index admissions for maternity diagnoses were followed by a readmission, accounting for 2% of total readmissions and less than 1% of all readmission costs.

Readmission rates varied by patient age: older patients were much more likely than younger patients to be readmitted for any reason, and also more likely to be readmitted for complications or infections **(Table II.3)**. Patients aged 65 or older accounted for more than half of all readmissions and readmission costs in New York State in 2008. More than one-third of all readmissions for these patients were linked to complication and infection, compared with 22% of readmissions for patients aged 45 to 64 and 11% of readmissions for patients aged 18 to 44.

TABLE II.3. Number and Cost of 30-Day Readmissions by Patient Age, 2008

	NUMBER OF READMISSIONS	READMISSION RATE	PERCENTAGE OF TOTAL READMISSIONS	PAYMENTS FOR READMISSIONS ($ MILLIONS)	PERCENTAGE OF TOTAL READMISSION COSTS
READMISSIONS FOR ANY REASON WITHIN 30 DAYS	273,575	14.6%	100.0%	$3,744.0	100.0%
PATIENT AGE:					
18–24 years old	8,880	6.9%	3.2%	$101.4	2.7%
25–44 years old	43,043	9.4%	15.7%	$484.0	12.9%
45–64 years old	78,407	15.1%	28.7%	$1,094.8	29.2%
65 or older	143,245	18.7%	52.4%	$2,063.8	55.1%
READMISSIONS FOR COMPLICATIONS OR INFECTIONS WITHIN 30 DAYS	72,656	3.9%	26.6%	$1,290.6	34.5%
PATIENT AGE:					
18–24 years old	768	0.6%	0.3%	$12.8	0.3%
25–44 years old	5,177	1.1%	1.9%	$82.2	2.2%
45–64 years old	17,550	3.4%	6.4%	$323.1	8.6%
65 or older	49,162	6.4%	18.0%	$872.6	23.3%

SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

NOTE: See Table II.1.

Given the strong association between age and readmission rate, it is unsurprising that most readmissions occurred following stays for which Medicare paid **(Table II.4)**. Nearly 20% of Medicare stays in 2008 resulted in a readmission, accounting for 58% of all readmissions and 60% of all readmission costs ($2.3 billion). Nearly one-third of readmissions following a Medicare stay were for complications or infections, accounting for 32% of all readmissions and 24% of all readmission costs ($909 million).

Readmissions were less common following index stays paid by either Medicaid or private insurance. In 2008, 15% of Medicaid stays were followed by a readmission, accounting for 20% of readmission costs ($757 million). Just 8% of stays paid by commercial insurance resulted in a readmission, but on average these were more costly than Medicaid readmissions, at least

in part due to higher commercial payment rates for hospital care. Readmissions following a private-pay stay accounted for 15% of all readmissions costs ($569 million) in 2008.

TABLE II.4. Number and Cost of 30-Day Readmissions by Primary Payer, 2008

	NUMBER OF READMISSIONS	READMISSION RATE	PERCENTAGE OF TOTAL READMISSIONS	PAYMENTS FOR READMISSIONS ($ MILLIONS)	PERCENTAGE OF TOTAL READMISSION COSTS
READMISSIONS FOR ANY REASON WITHIN 30 DAYS	273,575	14.6%	100.0%	$3,744.0	100.0%
EXPECTED PAYER OF INDEX ADMISSION:					
Medicare	157,566	19.6%	57.6%	$2,261.6	60.4%
Medicaid	57,949	15.0%	21.2%	$756.7	20.2%
Commercial insurance	45,102	8.4%	16.5%	$568.9	15.2%
Self-pay (uninsured)	8,288	8.7%	3.0%	$101.4	2.7%
All other	4,669	9.2%	1.7%	$55.5	1.5%
READMISSIONS FOR COMPLICATIONS OR INFECTIONS WITHIN 30 DAYS	72,656	3.9%%	26.6%	$1,290.6	34.5%
EXPECTED PAYER OF INDEX ADMISSION:					
Medicare	51,050	6.3%	32.4%	$909.1	24.3%
Medicaid	7,696	2.0%	4.9%	$158.9	4.2%
Commercial insurance	11,478	2.1%	7.3%	$183.9	4.9%
Self-pay (uninsured)	1,274	1.3%	0.8%	$22.7	0.6%
All other	1,158	2.3%	0.7%	$16.0	0.4%

SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

NOTE: See Table II.1.

Readmission rates were higher in some regions of the state than in others. In particular, stays at hospitals in the New York City metropolitan area or Capital District were more likely to result in a readmission than stays at hospitals in the western or central regions of the state (Table II.5). Readmissions associated with hospital stays in the New York Metro area accounted for 72% of readmissions statewide and nearly 80% of all readmissions costs, roughly proportionate to its share of total stays and total hospital costs.

Readmission rates showed little variation by type of hospital. Readmission rates associated with stays in major teaching hospitals and hospitals serving a disproportionate number of low-

income patients were somewhat higher than for other hospitals, but readmission rates among these hospital types averaged at most approximately one percentage point higher than that among other hospitals. Reflecting their large share of all admissions and their generally more complex case mix (an issue addressed below), major teaching hospitals accounted for 43 of all readmissions and nearly half (49%) of all readmission costs. Disproportionate share hospitals—many of them also teaching hospitals—accounted for a large majority of readmissions (72%) and readmission costs (75%) in 2008.

TABLE II.5.
Number and Cost of 30-Day Readmissions by the Location of the Index-Admission Hospital, 2008

	NUMBER OF READMISSIONS	READMISSION RATE	PERCENTAGE OF TOTAL READMISSIONS	PAYMENTS FOR READMISSIONS ($ MILLIONS)	PERCENTAGE OF TOTAL READMISSION COSTS
READMISSIONS FOR ANY REASON WITHIN 30 DAYS	273,575	14.6%	100.0%	$3,744.0	100.0%
LOCATION OF THE INDEX ADMISSION HOSPITAL:					
New York City	127,496	15.2%	46.6%	$2,051.1	54.8%
Other New York Metro[a]	69,515	14.5%	25.4%	$941.2	25.1%
Western Region	36,112	13.6%	13.2%	$358.7	9.6%
Central	20,446	13.6%	7.5%	$208.0	5.6%
Capital District	20,006	14.5%	7.3%	$185.0	4.9%
READMISSIONS FOR COMPLICATIONS OR INFECTIONS WITHIN 30 DAYS	72,656	3.9%	26.6%	$1,290.6	34.5%
LOCATION OF THE INDEX ADMISSION HOSPITAL:					
New York City	30,780	3.7%	42.4%	$682.3	18.2%
Other New York Metro[a]	19,501	4.1%	26.8%	$338.3	9.0%
Western Region	10,674	4.0%	14.7%	$130.0	3.5%
Central	5,957	4.0%	8.2%	$74.6	2.0%
Capital District	5,744	4.2%	7.9%	$65.3	1.7%

SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

NOTE: See Table II.1.

[a] Includes Long Island and New Rochelle.

TABLE II.6.
Number and Cost of 30-Day All-Cause Readmissions by Type of Index-Admission Hospital, 2008

	NUMBER OF READMISSIONS	READMISSION RATE	PERCENTAGE OF TOTAL READMISSIONS	PAYMENTS FOR READMISSIONS ($ MILLIONS)	PERCENTAGE OF TOTAL READMISSION COSTS
READMISSIONS FOR ANY REASON WITHIN 30 DAYS	273,575	14.6%	100.0%	$3,744.0	100.0%
TYPE OF INDEX ADMISSION HOSPITAL:					
OWNERSHIP:					
Not for profit	237,373	14.6%	86.8%	$3,090.9	82.6%
All others	36,202	14.9%	13.2%	$653.1	17.4%
TEACHING STATUS:					
Major teaching hospital	118,642	14.8%	43.4%	$1,819.4	48.6%
Other teaching hospital	96,185	14.4%	35.2%	$1,278.9	34.2%
Non-teaching	56,380	14.5%	20.6%	$645.7	17.2%
DISPROPORTIONATE SHARE HOSPITAL:					
Yes	196,450	14.9%	71.8%	$2,793.4	74.6%
No	74,664	13.8%	27.3%	$903.2	24.1%

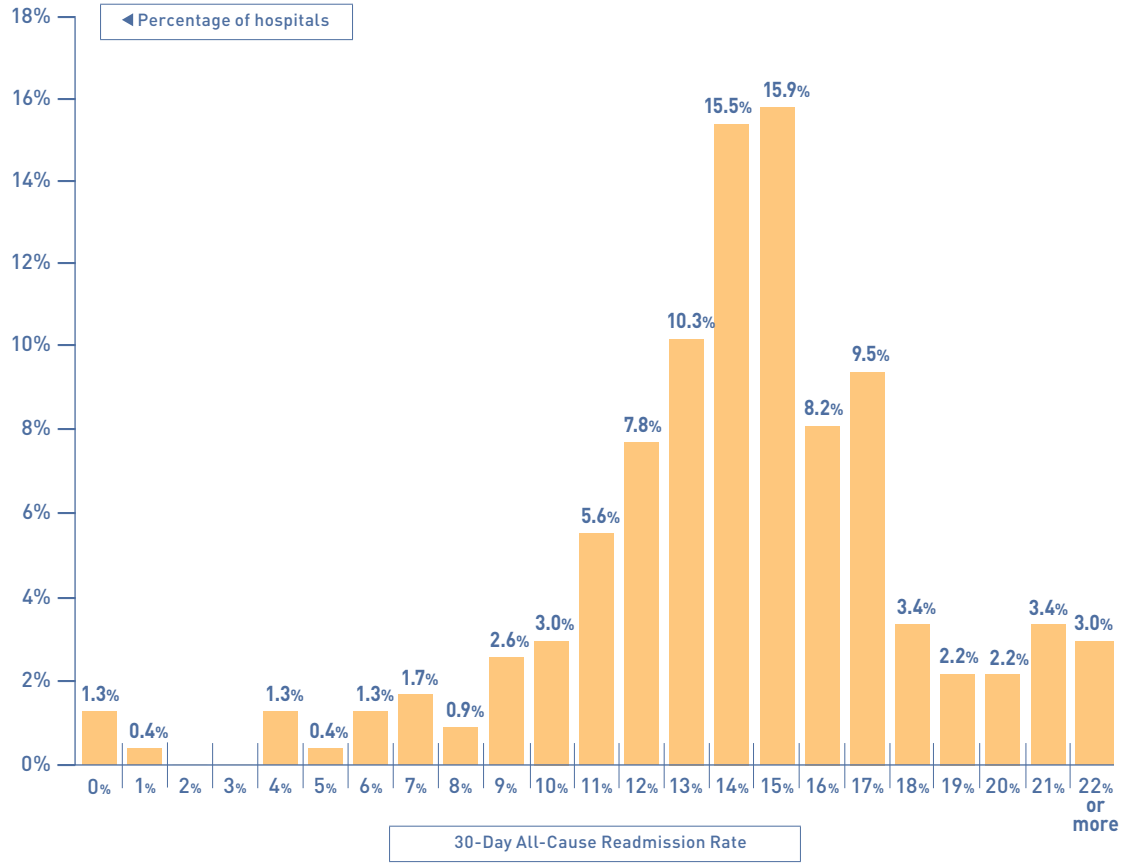
SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

NOTES: See Table II.1 notes. Low-income Medicare beneficiaries receiving supplemental security income (SSI) and low-income Medicaid beneficiaries account for a high proportion of inpatient days in hospitals designated as disproportionate share hospitals. In 2008, 55% of all acute-care hospitals in New York State (129 of 234 in total) were disproportionate share hospitals.

INDIVIDUAL HOSPITAL VARIATION IN READMISSION RATES

Despite relatively little variation between different types of hospitals, there was substantial variation among individual hospitals' readmission rates in 2008. While nearly one-third of hospitals (31%) had readmission rates of 14 to 15%, nearly 13% of hospitals had readmission rates of 10% or less. Nine percent of hospitals had readmission rates of 20% or more—at least 50% above the statewide average **(Figure II.1)**.

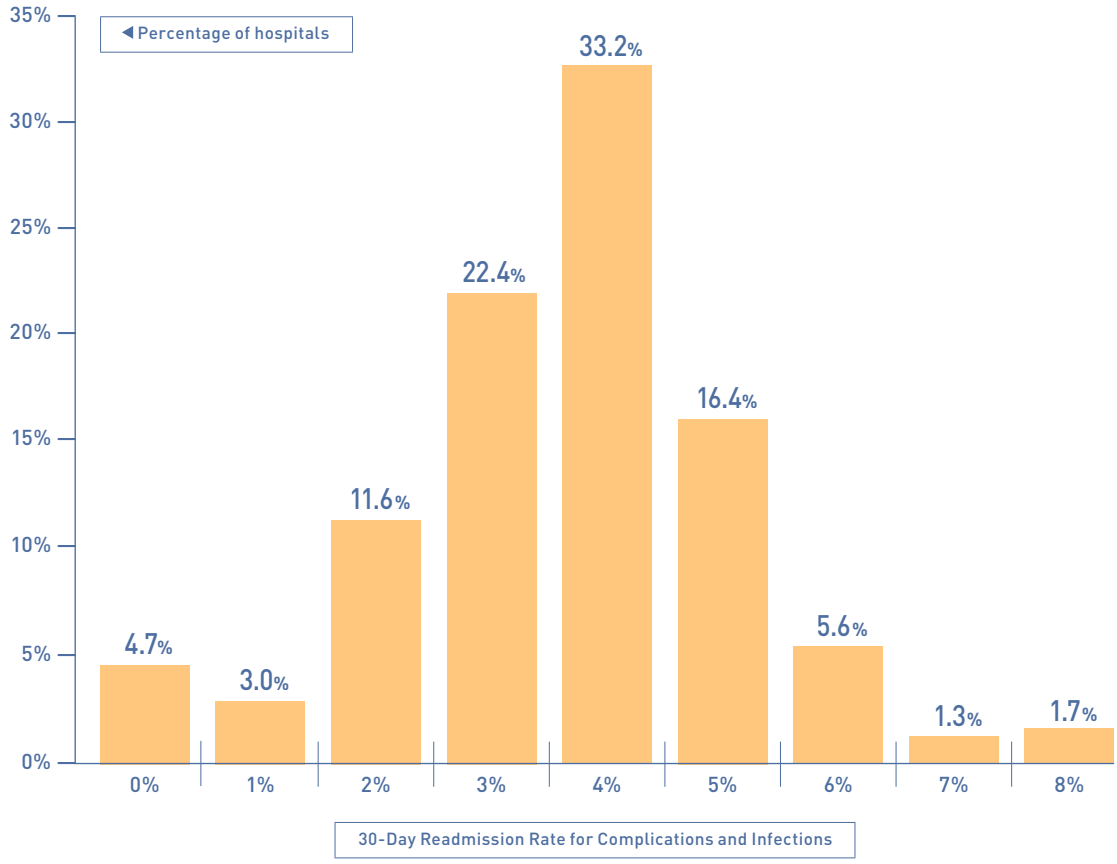
FIGURE II.1. Distribution of Hospitals by 30-Day All-Cause Readmission Rates, 2008



SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

Individual hospitals also performed very differently with respect to their rates of readmission for complications or infections (Figure II.2). One-third of all hospitals (33%) had 30-day readmission rates of 4% associated with complications and infections—approximately the statewide average. But in 9% of hospitals, readmission rates for complications and infections were 6% or more, and in 2% of hospitals, they were 8% or more—at least twice the statewide average.

FIGURE II.2. Distribution of Hospitals by 30-Day Readmission Rates for Complications and Infections, 2008



SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

Some of the variation in readmission rates between hospitals may be because of differences in hospital case mix. Across all hospitals, index admissions for some conditions—particularly for certain chronic conditions—were much more likely to be followed by a readmission. Approximately 28% of index admissions for heart failure were followed by a readmission within 30 days in 2008 (Table II.7). Similarly, at least 25% of index admissions for septicemia and disseminated infections, alcohol or opioid abuse and dependence, or renal failure were followed by a readmission.

TABLE II.7.
Thirty-day All-Cause Readmission Rates by Index-Admission Diagnosis, 2008

	TOTAL INDEX ADMISSIONS RESULTING IN A READMISSION	READMISSION RATE	PERCENTAGE OF ALL READMISSIONS
ALL INDEX ADMISSIONS	273,575	14.6%	100.0%
INDEX-ADMISSION APR-DRGS WITH THE HIGHEST READMISSION RATES:[a]			
Heart failure	15,059	28.3%	5.5%
Chronic obstructive pulmonary disease (COPD)	9,540	22.9%	3.5%
Septicemia & disseminated infections	7,793	26.7%	2.8%
Other pneumonia	7,440	16.9%	2.7%
Schizophrenia	6,506	23.1%	2.4%
Alcohol abuse and dependence	5,363	25.1%	2.0%
Opioid abuse and dependence	5,082	25.9%	1.9%
Renal failure	5,582	25.1%	2.0%
Cardiac arrhythmia and conduction disorder	5,456	15.9%	2.0%
Percutaneous cardiovascular procedures	5,317	13.9%	1.9%
Bipolar disorders	4,373	20.2%	1.6%
Kidney & urinary tract infections	4,766	17.2%	1.7%
Angina pectoris and coronary atherosclerosis	4,490	17.5%	1.6%
Major depressive disorders & other psychosis	3,959	17.6%	1.4%
Cellulitis and other bacterial skin infections	4,068	12.5%	1.5%
Diabetes	3,599	17.0%	1.3%
All other APR-DRGs	175,181	12.6%	64.0%

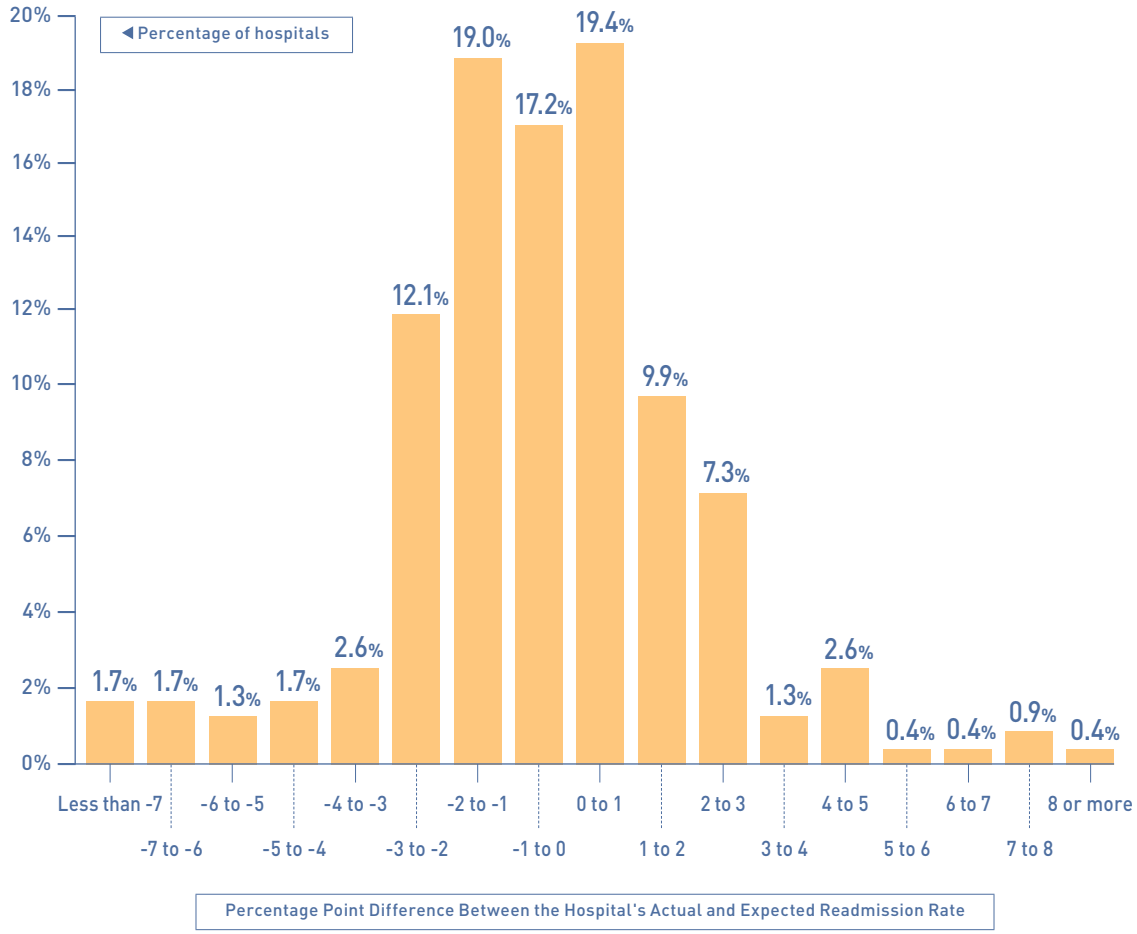
SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

NOTES: See Table II.1 notes.

[a] Index stays were classified using All Patient Refined Diagnosis Related Groups (APR-DRGs), which group hospital stays for similar diagnoses and severity of illness.

To account for differences in readmission rates related to differences in hospital case mix, we calculated the difference between each hospital's actual readmission rate and its expected readmission rate. A hospital's expected readmission rate is the readmission rate that would have occurred had it achieved the statewide average readmission rate for its case mix. In 2008, about one-third of all hospitals (37%) had an actual readmission rate within one percentage point of their expected rates (Figure II.3). All other hospitals either outperformed their expected rates by more than a percentage point (40%) or underperformed by the same margin (23%). Six percent of hospitals had actual readmission rates that were at least three percentage points above their expected rates.

FIGURE II.3. Distribution of Hospitals by the Percentage-Point Difference between Actual and Expected Readmission Rates, 2008



SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

NOTES: Negative values indicate a hospital's actual readmission rate was below (better than) its expected rate, given its case mix of index admissions. Positive values indicate a hospital's actual readmission rate was above (worse than) its expected rate.

While major teaching hospitals showed, on average, just a slightly higher rate of actual readmissions in 2008, they were much more likely to have actual readmission rates above their expected rates. In 2008, nearly 40% of major teaching hospitals had actual rates of readmission more than a percentage point higher than their expected rates, compared with 17 to 18% of other teaching and nonteaching hospitals (Table II.8). Disproportionate share hospitals also were much more likely to have readmission rates above their expected rates than other hospitals (30% versus 14% among other hospitals), although their actual average readmission rate was only moderately higher.

In the following chapter we describe strategies to reduce rates of hospital readmissions and the research evidence supporting their effectiveness. We select two of these strategies with arguably the strongest empirical evidence of effectiveness for the microsimulation analysis that comprises the balance of this report.

TABLE II.8.
Actual and Expected Readmission Rates by Type of Hospital, 2008

	NUMBER OF HOSPITALS	ACTUAL READMISSION RATE	ACTUAL READMISSION RATE COMPARED WITH THE HOSPITAL'S EXPECTED RATE		
			BETTER (READMISSION RATE WAS AT LEAST ONE PERCENTAGE POINT BELOW EXPECTED)	ABOUT EQUAL (READMISSION RATE WAS WITHIN +/- 1 PERCENTAGE POINT OF EXPECTED)	WORSE (READMISSION RATE WAS AT LEAST ONE PERCENTAGE POINT ABOVE EXPECTED)
ALL HOSPITALS	232	14.6%	40.1%	36.6%	23.3%
OWNERSHIP:					
Not-for-profit	205	14.6%	39.5%	37.6%	22.9%
Other	27	14.9%	44.4%	29.6%	25.9%
TEACHING STATUS:					
Major Teaching	53	14.8%	20.8%	39.6%	39.6%
Other Teaching	69	14.4%	44.9%	36.2%	18.8%
Non-teaching	108	14.5%	47.2%	35.2%	17.6%
DISPROPORTIONATE SHARE HOSPITAL:					
Yes	129	14.9%	34.9%	34.9%	30.2%
No	100	13.8%	47.0%	39.0%	14.0%

SOURCE: Mathematica Policy Research analysis of New York SPARCS hospital discharge data.

NOTES: See Table II.1. Two of the 234 acute-care hospitals identified in this study had no stays qualifying as index admissions, and are not included in the hospital-specific tables and figures.

Hospital Strategies to Reduce Readmissions

The growing body of research investigating factors that contribute to hospital readmissions has led to broad agreement among clinical experts and other stakeholders that improving the discharge process and providing support immediately post-discharge are essential to reducing the number of readmission (Minott 2008). In turn, a number of clinical interventions have been piloted for populations most at-risk for readmissions (such as older patients and patients with congestive heart failure), and some have been found to be effective in reducing the likelihood of readmission. This chapter briefly reviews the literature evaluating these interventions.

FACTORS THAT CONTRIBUTE TO READMISSIONS

Fragmentation of care across settings is a major contributor to readmissions. Over the past two decades, patients have become less likely to see their primary care physicians when hospitalized, and more likely to see a hospitalist (a physician who provides care only to hospitalized patients). This trend has created a heightened need for care coordination and information sharing of among providers as patients are admitted and discharged from hospitals, beyond the limits of a typical discharge process (Bodenheimer 2008). Instead, hospitals' discharge processes and timelines generally are oriented toward documentation (not notification) and implicitly assume that patients' primary care physicians were involved with their inpatient care. Fewer than one in five primary care physicians report being routinely notified when their patients are discharged from a hospital (Kripalani *et al*. 2007). Moreover, even when the primary care physician receives a discharge summary, it often lacks key information about the patient's discharge diagnosis, test results, medications prescribed, or plans for follow-up care.

When primary care physicians are not notified about an admission through the discharge process, patients themselves become the primary source of information about their hospital stay. But patients often do not understand their condition and treatment plan as well as hospital-based physicians may assume. One study found that, while nearly 90% of physicians believed patients understood key information about the side effects of their medications and when to resume normal activity following discharge, less than 60% of their patients actually said they understood (Calkins *et al*. 1997). Such poor communication often leaves patients and family members abruptly expected to manage problems encountered after discharge with little preparation (Coleman and Berenson 2004). Unknowledgeable about their condition and confused about who is responsible for their care immediately following discharge, many patients may return to the hospital when they experience problems that might have been treated successfully without readmission.

Poor communication between physicians and patients, or between different physicians treating the same patient in different settings, can also generate medication errors. One study found that nearly 13% of discharged patients suffered an injury caused by medication errors; many required

re-admission (Foster *et al*. 2003). Poor communication among the hospitalist, the patient, and the patient's primary care physician was identified as a contributing factor in most cases.

Medication errors often occur when the prescribing physician has incomplete information about the patient. In one study, 94% of patients discharged from an ICU were found to have medication errors that the treating physician corrected when presented with current information about the patient's other prescriptions and allergies (Provonost *et al*. 2003). Medication errors also occur when patients fail to correctly take the medications that were prescribed during their stay after leaving the hospital. At least 14% of recently discharged patients may not comply with the medications specified in their discharge instructions—often because the instructions are illegible or incomplete, contain conflicting information about what kind of medicine or dosage to take, or duplicate older prescriptions without informing the patient that previously-prescribed drugs must be discontinued (Moore *et al*. 2003, Coleman *et al*. 2005).

INTERVENTIONS TO REDUCE READMISSIONS

At least four factors are widely viewed as important to effective discharge planning: (1) coordination between the hospital-based and primary care physician, (2) better communication between the hospital-based physician and the patient, (3) better education and support for patients to manage their own condition, and (4) reconciliation of medications at discharge or immediately afterward (Kripalani *et al*. 2007). While many of the most promising interventions for lowering readmission rates address some or all of these factors, relatively few have been rigorously evaluated (Minott 2008).

However, the interventions that have been have been rigorously evaluated, based on one or more randomized controlled trials (RCTs), are summarized in Table III.1. Most of these interventions have focused on enhancing the discharge process or educating patients about self-management of their condition (Boutwell and Hwu 2009). The intervention often included formal review or reconciliation of medications as part of the discharge process or immediately after discharge. One meta-analysis of 18 different interventions targeting older patients with congestive heart failure found that comprehensive discharge planning plus post-discharge support reduced the probability of readmission by 25% (Phillips *et al*. 2004). More intensive post-discharge services did not appear to be more effective than less intensive services: a single home visit, multiple home visits, and frequent telephone follow-ups were all effective in reducing the likelihood of readmissions.

Several of the tested interventions targeted older adults, who typically experience the highest rates of readmission. One such intervention, the Transitional Care Model, was evaluated for older patients with congestive heart failure or respiratory infection, or who underwent cardiac surgery, orthopedic surgery, or bowel procedures. An advanced practice nurse (APN) visited each patient regularly during the hospital stay to evaluate patient and caregiver needs, develop an individualized discharge plan, and educate the patient about self-care after discharge. The APN also provided post-discharge support in the form of home visits and telephone calls. In three different RCTs, this model was shown to significantly reduce readmissions over periods ranging from 2 to 52 weeks after discharge (Naylor *et al*. 1994; Naylor *et al*. 1999; Naylor *et al*. 2004).

The Care Transitions Intervention (CTI) also targets older patients, focusing on those with one of 11 high-risk conditions. As with the Transitional Care Model, an APN serves as a patient advocate during the discharge process and continues to provide post-discharge support through in-person visits and telephone calls. The APN assists the patient in coordinating post-discharge care, although the larger focus is education and empowering the patient to take an active role in managing his disease and coordinating his own care. CTI involves a formal medication reconciliation process during the first home visit to identify and resolve any discrepancies between prescriptions before and after the hospital stay. CTI was shown to reduce 30-day all-cause readmissions by 30% (Coleman 2006).

TABLE III.1.
Summary of Interventions to Reduce Hospital Readmissions and Randomized Control led trial Evaluation Results

INTERVENTION	POPULATION	COMPONENTS OF THE INTERVENTION			EVALUATION RESULTS
		IN-HOSPITAL PATIENT ADVOCATE	POST-DISCHARGE FOLLOW-UP	MEDICATION RECONCILIATION	
Transitional Care Model	Patients aged 65+ with CHF, AMI, or respiratory tract infection; or undergoing CABG, cardiac valve replacement, major bowel surgery, or orthopedic surgery	APN in-person visits every 48 hours	8 in-person visits by APN in 3 months after discharge	No formal process	Multiple RCTs showed reduced all-cause readmission rates during periods from 2 to 52 weeks after discharge
Care Transitions Intervention	Patients aged 65+ with one of 11 high-risk conditions	Advanced Practice Nurse (APN)	1 in-person visit and 3 telephone calls from APN	Yes	One RCT showed a 30% reduction in 30-day all-cause readmission rates
Project RED	Patients of all ages with medical stays	Nurse discharge advocate	1 telephone call from pharmacist 2-4 days after discharge	Yes	One RCT showed a 32% reduction in 30-day all-cause readmissions
Post-discharge pharmacist calls	Patients of all ages with medical stays discharged to home	None	1 telephone call from pharmacist 2-4 days after discharge	Yes	One RCT showed reduction in 30-day all-cause readmission rates, but not statistically significant
Redesigned discharge form	Patients of all ages with medical or surgical stays	None	1 telephone call from RN in office of outpatient physician	No	One RCT showed no reduction in 30-day all-cause readmission rates

SOURCE: Mathematica Policy Research.

Three interventions targeted patients of all ages. Project Re-Engineered Discharge (RED) uses a nurse advocate to assist patients in navigating the discharge process, as well as a clinical pharmacist who telephones the patient 2 to 4 days after discharge to reconcile medications. Project RED was shown to reduce 30-day all-cause readmissions by 32% (Jack *et al*. 2009). Another intervention that had a pharmacist placing a telephone call to reconcile medications in the days after discharge also decreased readmission rates substantially, but the change was not statistically significant (Dudas *et al*. 2001). An intervention that involved a redesigned discharge form, but no formal reconciliation of medications or additional patient education and coaching, did not reduce readmissions (Balaban *et al*. 2008).

Some of the evaluations described above also compared the direct costs of the intervention to the costs savings due to lower readmissions. In most cases, the amounts that would have been paid for readmissions were larger than the direct costs of the intervention; even relatively intense and expensive interventions reduced net medical spending. However, in practice the savings from lower readmissions accrue to payers—Medicare, Medicaid, commercial health insurance companies, and the patients themselves—while hospitals shoulder the direct costs of the intervention. When paid per admission, hospitals would also face a revenue loss from fewer readmissions.

The next chapter explores this problem of incentives for hospitals to invest in reducing readmissions and reviews changes in payment methods that might cause hospitals to invest in reducing readmissions. We consider hospital decisions to adopt either of two clinical interventions described above: CTI or Project RED. Both models have been rigorously evaluated and tested on a range of patients with different diagnoses, and estimates of their resource costs are public information.

Payment Incentives to Reduce Readmissions

Policymakers have long been concerned about the lack of incentives for providers to improve health care quality under a fee-for-service payment system, which provides few if any apparent incentives for quality of care and probably contributes to service overuse and cost (Leatherman *et al*. 2003). These concerns have motivated some payers to develop payment reforms that modify or replace fee-for-service payment.

In this chapter, we consider the decision process of a hospital whose business model is simply to maximize revenues. Such a hospital would weigh the direct and indirect costs of reducing readmissions with the likely financial benefits, and proceed to invest in reducing readmissions only if the expected financial benefits outweigh the costs. The basic cost components of this calculus are discussed below with reference to two alternative clinical interventions that were described in Chapter 3: the Care Transitions Intervention (CTI) and Project Re-Engineered Discharge (RED). The financial benefits are discussed with reference to two alternative payment reforms, pay-for-performance (P4P) and episode-based payments, each structured to encourage hospitals to reduce readmissions. Because each cost component could differ according to a hospital's particular circumstances, different hospitals could make different decisions to invest in reducing readmissions when confronted with the same payment incentives.

DIRECT COSTS

Clinical interventions to reduce readmissions entail both labor and capital costs. Labor costs are incurred to manage transitions from the hospital to home or other settings. Capital costs, at least with respect to the clinical interventions that have been rigorously evaluated in the research literature, are minimal. Potentially they include only the opportunity cost of funds allocated to finance labor.

As described in Chapter 3, CTI targets patients with any of 11 high-risk conditions. CTI entails use of an advanced practice nurse who serves as an advocate for these patients during the discharge process, helps them coordinate post-discharge care, and formally reconciles their medications during an initial home visit. Estimated for 2008 and calculated regionally for New York State, these costs per discharge would have varied for hospitals across the state due to regional differences in labor costs and by the number of patients per year the advance practice nurse manages. Hospitals in nonmetropolitan southwest New York State would have paid as little as $198 per discharge to implement CTI, while hospitals in the New York-White Plains-Wayne metropolitan area would have paid as much as $348 **(Table IV.1)**.

In contrast, Project RED targets all patients discharged from a medical stay. It uses a nurse advocate to assist patients in navigating the discharge process, as well as a clinical pharmacist who telephones the patient to reconcile medications. This intervention is less costly per admission than CTI because it does not entail home visits. In 2008, the cost of implementing Project RED

would have ranged from as little as $111 per discharge for hospitals in the nonmetropolitan Capital/Northern New York area to $132 per discharge for hospitals in Nassau-Suffolk (Table IV.2). However, because Project RED is not as narrowly targeted (it would apply to all patients discharged from the hospital to home, not only those with selected high-risk diagnoses), the total cost of implementing it can be higher depending on the hospital's case mix.

TABLE IV.1.
Expected Cost of CTI per Admission by Region of New York State, 2007

	AVERAGE ANNUAL COMPENSATION FOR A REGISTERED NURSE		EXPECTED AVERAGE COST OF A CARE TRANSITIONS INTERVENTION PER ADMISSION	
	AVERAGE ANNUAL WAGE	TOTAL AVERAGE ANNUAL COMPENSATION	LOW ESTIMATE	HIGH ESTIMATE
METROPOLITAN AREAS				
Albany-Schenectady-Troy	$56,040	$73,300	$218	$255
Binghamton	$52,350	$68,474	$204	$238
Buffalo-Niagara Falls	$56,180	$73,483	$219	$255
Elmira	$48,140	$62,967	$187	$219
Glens Falls	$54,410	$71,168	$212	$247
Ithaca	$52,020	$68,042	$203	$236
Kingston	$55,280	$72,306	$215	$251
Nassau-Suffolk, Metropolitan Division	$73,440	$96,060	$286	$334
New York-White Plains-Wayne	$78,920	$103,227	$307	$358
Poughkeepsie-Newburgh-Middletown	$65,810	$86,079	$256	$299
Rochester	$54,860	$71,757	$214	$249
Syracuse	$52,770	$69,023	$205	$240
Utica-Rome	$52,290	$68,395	$204	$237
NON-METROPOLITAN AREAS				
Capital/Northern New York	$52,170	$68,238	$203	$237
Central New York	$52,970	$69,285	$206	$241
East-central New York	$53,720	$70,266	$209	$244
Southwest New York	$48,540	$63,490	$189	$220

SOURCES: Mathematica Policy Research. Average annual wages are from *Metropolitan Area Cross-Industry Estimates*, May 2007 (Bureau of Labor Statistics). The percentage of total compensation other than wages is the national average for hospital-based nurses, from *Employer Costs for Employee Compensation*, Table 14, June 2007 (Bureau of Labor Statistics).

NOTES: The estimates assume that the transition coordinator is an RN who is paid the local average annual wage and manages 288 patients (high estimate) to 336 patients (low estimate) per year, based a published evaluation of the CTI demonstration (Coleman *et al.* 2006). Total compensation costs include the cost of all non-wage compensation (FICA, paid leave, health insurance, retirement benefits, and supplemental pay); nonwage compensation averaged 30.8 percent of total compensation for hospital-based RNs nationally in 2007.

TABLE IV.2.
Expected Cost of Project RED per Admission by Region of New York State, 2007

GEOGRAPHIC AREA	AVERAGE ANNUAL COMPENSATION FOR A PHYSICIAN ASSISTANT		AVERAGE ANNUAL COMPENSATION FOR A PHARMACIST		EXPECTED COST OF PROJECT RED INTERVENTION PER ADMISSION
	AVERAGE ANNUAL WAGE	TOTAL COMPENSATION	AVERAGE ANNUAL WAGE	TOTAL COMPENSATION	
METROPOLITAN AREAS					
Albany-Schenectady-Troy	$80,300	$104,711	$90,900	$118,534	$104
Binghamton	n/a	n/a	$89,000	$116,056	$103
Buffalo-Niagara Falls	$74,900	$97,670	$96,470	$125,797	$101
Elmira	n/a	n/a	$102,010	$133,021	$107
Glens Falls	$84,740	$110,501	$88,100	$114,882	$107
Ithaca	n/a	n/a	$98,000	$127,792	$106
Kingston	n/a	n/a	$98,450	$128,379	$106
Nassau-Suffolk, Metropolitan Division	$87,630	$114,270	$102,690	$133,908	$115
New York-White Plains-Wayne	$85,880	$111,988	$94,690	$123,476	$110
Poughkeepsie-Newburgh-Middletown	$82,270	$107,280	$103,510	$134,977	$110
Rochester	$76,700	$100,017	$108,490	$141,471	$106
Syracuse	$75,810	$98,856	$100,110	$130,543	$103
Utica-Rome	$84,380	$110,032	$103,470	$134,925	$112
NON-METROPOLITAN AREAS					
Capital/Northern New York	$71,630	$93,406	$91,730	$119,616	$96
Central New York	$85,860	$111,961	$94,230	$122,876	$110
East-central New York	$86,360	$112,613	$106,500	$138,876	$115
Southwest New York	$72,250	$94,214	$99,630	$129,918	$99

SOURCES: Mathematica Policy Research. Average annual wages are from Metropolitan Area Cross-Industry Estimates, May 2007 (U.S. Bureau of Labor Statistics). The percentage of total compensation other than wages is the national average for hospital-based professionals, from Employer Costs for Employee Compensation, Table 14, June 2007 (U.S. Bureau of Labor Statistics).

NOTES: The estimated cost per index admission assumes 0.5 hours of pharmacist time and 1.5 hours of non-physician provider time per patient (Jack *et al.* 2009). Total compensation includes the cost of all non-wage compensation (FICA, paid leave, health insurance, retirement benefits, and supplemental pay) for non-RN hospital-based professionals, which averaged 30.4% of total compensation nationally in 2007; "n/a" indicates that estimates are unavailable.

INDIRECT COSTS

In considering whether to intervene to reduce readmissions, a revenue-maximizing hospital presumably would also consider its indirect costs. With fee-for-service payment (even when hybridized to include P4P incentives), hospitals receive additional revenue when they readmit a patient—and conversely, they lose revenue when they readmit fewer patients. Plainly stated,

a hospital whose business model is to maximize inpatient revenues might not make an effort to reduce readmissions, all else equal—regardless of the level of direct costs the effort would require. Each readmission it avoids would simply represent revenue foregone.

Indeed, with fee-for-service payment, the financial incentives associated with hospitals' indirect costs are strongly perverse, as long as the hospital expects to at least break even on the next readmission. A hospital's indirect costs would be highest (and, therefore, its fee-for-service incentives to reduce readmissions would be lowest) when a relatively high share of its revenue comes from readmitting patients it had previously discharged.[9] Moreover, the more effective the intervention, the greater this hospital's indirect cost would be—and, therefore, the less likely the hospital would be to implement it.

FINANCIAL BENEFITS

For a revenue-maximizing hospital to make an effort to reduce readmissions, it would need to anticipate a financial reward for reducing readmissions of sufficient magnitude to offset its cost disincentives. We consider two payment reforms intended to offer such a reward: P4P and episode-based payments. Each is discussed below.

Pay for Performance

P4P is a particular instance of a broader set of payment reforms called value-based purchasing (Rosenthal *et al*. 2006, Rosenthal 2009, Miller 2009). P4P initiatives typically use evidence-based measures of quality, effectiveness, and efficiency to classify or select providers, and to determine how much they are paid. Commercial P4P systems often use hybrid approaches, combining fee-for-service payment with payment bonuses or withholds that reflect provider performance on specific measures of quality or patient satisfaction (Bernstein *et al*. 2010).

Evidence of the effects of P4P systems is mixed, in no small part because of the difficulty of discerning their impact on care delivery, costs, or outcomes. However, many may simply offer too little financial incentive for providers to invest in quality improvement (Rosenthal *et al*. 2005).

A P4P system intended to reduce readmissions, when hybridized with fee-for-service, would pay hospitals with low case-mix-adjusted readmission rates more than it would pay hospitals with high case-mix-adjusted readmission rates. To invest in reducing readmissions, a revenue-maximizing hospital would need to see a financial benefit that outweighs its direct and indirect costs. That is, the hospital would need to succeed in increasing its P4P payment rate enough to offset both its higher cost per discharge and its revenue loss due to lower patient volume. Whether any one hospital would see such a net benefit is not immediately obvious. Indeed, the hospital's response would depend both on its own circumstances and on the particular P4P strategy used. All else equal, a hospital that expects a larger reduction in its readmission rate would be less inclined to invest in reducing readmissions, even when paid less per admission.

[9] Hospitals also receive revenue by readmitting patients discharged from other hospitals. For the purpose of this analysis, we assume that a hospital's decision as to whether to implement an intervention to reduce readmissions is made independently—that is, each hospital considers only the financial consequences it might produce when acting alone.

For payers, a potential advantage of P4P is the opportunity to retrieve savings immediately, even if hospital behavior does not change. Payers are most likely to retrieve P4P savings "off the top" by paying low-performing hospitals less, while making little or no adjustments to payment rates for high-performing hospitals. This practice limits high-performing hospitals' incentives to further reduce readmissions, although it might be efficient if currently low-performing hospitals offer the greatest potential for reducing aggregate readmissions.

Episode-Based Payments

Episode-based payments would eliminate payments for some or all readmissions within some interval after discharge, removing much—if not all—of the perverse incentive associated with fee-for-service payments. For each index admission, the hospital would receive an increase in payment equal to the expected cost of readmissions. Each readmission would represent wholly unreimbursed cost.

With episode-based payment, every hospital would see a financial benefit from reducing readmissions regardless of how low its readmission rate might already be. However, a revenue-maximizing hospital would choose to invest in reducing readmissions only if its expected savings (that is, the expected change in its costs for readmissions) exceeded the direct cost of the intervention.

Thus, the hospital's decision to invest in reducing readmissions hinges on the same general factors as those that come into play for P4P, but the hospital considers them differently. All else equal, a hospital that expects a greater reduction in its readmission rate would be more inclined to invest in reducing readmissions.

For payers, the downside of episode-based payments would be their inability to retrieve immediate savings. If payments are set equal to the expected value of current payments for admissions plus expected (case-mix-adjusted) readmissions, aggregate payments in the short term would change very little, if at all. The only significant opportunity to retrieve savings would occur over time, as hospitals succeeded in reducing readmissions and payers re-benchmarked payments to a lower expected rate of readmissions.

In the next chapter, we estimate hospital responses to P4P and episode-based payment reforms, using a simulation modeling approach. We estimate whether hospitals in New York would adopt either CTI or Project RED under either payment reform and examine the resulting effects on statewide readmission rates and payments for hospital care.

Payment Reform Simulations

In this chapter, we present the results of four payment reform simulations and the resulting effects on readmissions and aggregate hospital payments. We estimate hospitals' adoption of either CTI or Project RED in response to two alternative payment incentives—P4P and episode-based payments. The simulations assume that each hospital would compare its cost of implementing either intervention to its expected financial benefit from reducing readmissions. A hospital would implement an intervention to reduce readmissions only if its expected benefit exceeded its expected cost.

The first payment reform we simulated is a P4P approach similar to those recently adopted by New York Medicaid and soon to be implemented by Medicare. Under this P4P approach, hospitals with readmissions exceeding an expected rate of readmissions, referred to as "excess" readmissions, would have their overall payments per admission reduced in an amount roughly equal to payments for those excess readmissions.

The second payment approach is an episode-based payment model, in which hospitals no longer receive incremental payments for each readmission—as under fee-for-service—but instead are paid an additional amount for each initial index stay intended to cover the expected costs of any readmissions that may occur. Thus, hospitals are at financial risk for each readmission, with no incremental revenue received for actual readmission costs.

These two payment approaches represent the two ends of a continuum of reforms designed to modify hospitals' incentives under fee-for-service (FFS) to increase the volume of admissions—including readmissions. On the one hand, P4P would continue to pay hospitals for each readmission, but it would reduce the level of payment to hospitals that have relatively high rates of readmissions. Since P4P retains FFS payment, fewer readmissions result in lower total payments. Payers, therefore, can immediately recoup the savings associated with lower rates of readmission.

In contrast, episode-based payments remove all fee-for-service incentives for hospitals to readmit the patients they discharge. However, in the short-term, hospitals retain the savings associated with reduced readmissions, so there is less immediate benefit to payers.

Variants of these payment reforms fall along a continuum in terms of how strongly they alter the existing FFS incentives (MedPAC 2007). For example, P4P approaches might incorporate stronger financial incentives that affect a greater number of hospitals, not only those with above-average rates of readmission. They might also reduce, though not eliminate, FFS payments for each readmission.

We observe very different hospital responses to P4P and episode-based payments. Each would result in reduced readmissions and total hospital payments, but both the magnitude of the response and the expected cost savings in the short term vary. As described in the concluding section, directly paying hospitals to undertake one of the evidence-based interventions to reduce readmissions (Project RED) might yield both more change in hospital processes of care and more savings to payers than instituting payment incentives.

HOSPITAL RESPONSE TO P4P

The P4P simulation assumed that each hospital would receive reduced payment in 2008 if its readmissions in 2007 exceeded a benchmark rate. The benchmark rate for each hospital was calculated as the statewide average readmission rate in 2006, adjusted for the hospital's case mix. For each payer, the amount of the potential payment reduction was calculated as the sum of payments for "excess" readmissions (that is, the number of readmissions above the benchmark rate) divided by total payments for all admissions to that hospital. Thus, if 1% of payments to a hospital in 2007 were for "excess" readmissions, then the payment per admission for all stays in 2008 would be reduced by 1%.

The simulation confronted each hospital with deciding whether to implement an intervention to reduce readmissions in 2007 in order to avoid reduced fee-for-service payments the following year. If the hospital's expected reduction in total payments in 2008 exceeded the sum of its direct costs for the intervention in 2007 plus its indirect costs (lost revenue from reduced readmissions) in 2007, then it would implement the intervention to reduce readmissions. We assumed that any hospital that chose to implement the intervention in 2007 would continue the intervention into 2008.

Based on this calculation, we found that relatively few hospitals would undertake the cost of an intervention to reduce readmissions: 7% of hospitals in New York would have implemented CTI in 2007, and 3% would have implemented Project RED (Table V.1).[10]

TABLE V.1.
Simulated Adoption of Evidence-Based Interventions under Alternative Payment Incentives, 2007

PAYMENT INCENTIVE	ALL HOSPITALS	HOSPITALS SUBJECT TO PAYMENT INCENTIVES	HOSPITALS THAT WOULD IMPLEMENT CTI		HOSPITALS THAT WOULD IMPLEMENT PROJECT RED	
			NUMBER	PERCENTAGE	NUMBER	PERCENTAGE
Pay-for-performance	238	82	17	7.1%	6	2.5%
Episode-based payments	238	238	194	81.5%	121	50.8%

SOURCE: Mathematica Policy Research analysis of New York hospital discharge data.

Under P4P, most hospitals would decline to invest because their 2007 readmission rates were below their benchmark expected readmission rates. These hospitals would have faced no payment reduction under P4P and, therefore, no benefit for reducing readmissions—only direct and indirect costs. Among the 82 hospitals that would have faced a payment reduction, only a small fraction would have acted to reduce readmissions.

[10] We assumed no rate of time preference in this decision. Had hospitals discounted returns in 2008, relative to the cost of investing in 2007, it is possible that still fewer hospitals would have undertaken the investment and impacts on readmissions would have been still less than we simulated.

Among adopters and non-adopters of the CTI intervention, the average readmission rate was almost identical (17%), as were the average direct and indirect costs of the intervention (Table V.2). However, the cost of excess readmissions among hospitals that would choose to adopt CTI ($3.2 million) was nearly twice as large as for non-adopters ($1.5 million). As a result these hospitals would have faced much larger potential payment reductions in 2008.

TABLE V.2.
Simulated Costs and Benefits of Reducing Readmissions for Hospitals Facing Payment Reduction under P4P, 2007

	NUMBER OF HOSPITALS	AVERAGE READMISSION RATE IN 2007	AVERAGE COST OF EXCESS READMISSIONS IN 2007 ($ MILLIONS)	AVERAGE POTENTIAL PAYMENT REDUCTION IN 2008 ($ MILLIONS)	AVERAGE PAYMENT REDUCTION AVOIDED IN 2008 IF 2007 READMISSIONS ARE REDUCED ($ MILLIONS)	AVERAGE INDIRECT COSTS OF REDUCING READMISSIONS IN 2007 ($ MILLIONS)	AVERAGE DIRECT COSTS OF REDUCING READMISSIONS IN 2007 ($ MILLIONS)
CTI							
Adopters	17	17%	$3.2	$3.4	$1.8	$1.2	$0.5
Non-adopters	66	17%	$1.5	$1.4	$0.9	$1.0	$0.4
PROJECT RED							
Adopters	6	23%	$2.0	$2.0	$1.8	$1.2	$0.3
Non-adopters	77	17%	$1.8	$1.7	$1.7	$3.4	$0.6

SOURCE: Mathematica Policy Research analysis of New York hospital discharge data.

Reflecting the different populations and conditions that each intervention targeted and the difference in the costs of each intervention, the hospitals that would choose to adopt CTI were (with just two exceptions) not the same hospitals that would adopt Project RED (data not shown). Hospitals that would adopt CTI expected to reduce the incidence of the most expensive readmissions, bringing down the cost of excess readmissions faster than the number of readmissions.[11] In contrast, Project RED targets all medical admissions (not only conditions with high-cost or high-likelihood readmissions) and is cost-effective under P4P only for hospitals with high readmission rates across all types of medical admissions. Hospitals that would adopt Project RED had higher readmission rates (23% versus 17% among non-adopters) and also faced much lower direct and indirect costs to achieve the same benefit as non-adopters.

Among hospitals that would decide to invest in reducing readmissions, the business case for doing so was generally strong. Calculated across all hospitals that would implement CTI, the estimated rate of return was 41% on an average intervention cost of $464,000 per hospital.

[11] Compared with Project RED, the CTI intervention is more expensive per discharge but targets a smaller number of high-cost, high-readmission conditions such as congestive heart failure. The simulation results might change if readmission performance under these P4P reforms were based on *number* of readmissions above the expected number rather than on cost of readmissions above the expected cost.

The estimated rate of return for hospitals that would implement Project RED was still greater: 112% on an average intervention cost of $292,000 per hospital (Table V.3).

TABLE V.3.
Simulated Hospital Costs and Benefits of Implementing Evidence-Based Interventions under Alternative Payment Incentives, 2007

	HOSPITALS THAT WOULD IMPLEMENT CTI			HOSPITALS THAT WOULD IMPLEMENT PROJECT RED		
PAYMENT INCENTIVE	NUMBER OF HOSPITALS	AVERAGE DIRECT COST ($ THOUSANDS)	AGGREGATE RATE OF RETURN	NUMBER OF HOSPITALS	AVERAGE DIRECT COST ($ THOUSANDS)	AGGREGATE RATE OF RETURN
Pay-for-performance	17	$463.7	41%	6	$291.9	112%
Episode-based payments	194	$415.0	111%	121	$711.4	75%

SOURCE: Mathematica Policy Research analysis of New York hospital discharge data.

NOTES: Average dollar amounts are reported per hospital. The average rate of return under pay-for-performance is calculated as the undiscounted reduction in the payment penalty in 2008, net of lost readmission revenue and intervention costs, as a percentage of the intervention costs. The rate of return under episode-based payment is the reduction in unreimbursed readmissions as a percentage of intervention costs.

HOSPITAL RESPONSE TO EPISODE-BASED PAYMENTS

We expect that revenue-maximizing hospitals would be uniformly more responsive to episode-based payments than to P4P (as we modeled these approaches). Under episode-based payments, hospitals would receive an enhanced payment for a patient's initial admission, but no payments for any subsequent readmission within 30 days. The enhanced payment is equivalent to the hospital's current fee-for-service payment for the initial stay, plus an additional payment intended to cover the average cost and likelihood of readmission for any reason.[12] Hospitals that successfully reduce readmissions to below the average statewide rate retain the difference. In each subsequent year, episode-based payments would be rebased to the current statewide readmission rate, reflecting hospital responses to episode-based payment incentives.

Because hospitals do not lose revenue from reducing readmissions (they are no longer paid fee-for-service for each readmission), they undertake investment if the benefit of avoiding an unreimbursed readmission costs exceeds the cost of the intervention. In addition, all hospitals stand to benefit from reducing readmissions under episode-based payment, not only those hospitals with relatively high case-mix-adjusted readmission rates.

Consistent with hospitals' universal exposure to episode-based payment incentives, four out of five hospitals (82%) would implement CTI, and more than half (51%) would implement Project RED (Table V.1). As was the case under pay-for-performance, more hospitals making a cost-benefit calculation would adopt CTI (which targets high-cost, high-readmission conditions), despite the higher average cost of CTI compared with Project RED.

[12] The likelihood of readmission for any reason within 30 days is based on the statewide average readmission rate for the DRG. As a result, hospitals with lower-than-expected readmission rates given their case mix would receive higher payments than they currently do under the FFS system, while hospitals with lower-than-expected readmission rates would experience payment reductions compared to the current payment system.

As under P4P, the hospitals that would implement either CTI or Project RED under episode-based payments generally had a strong business case for doing so. The estimated rate of return among hospitals that would implement CTI was 111% on an average intervention cost of $415,000 (Table V.3). Among those that would implement Project RED, the estimated rate of return was 75% on an average intervention cost of $711,444.

EFFECT ON THE NUMBER OF READMISSIONS

The simulations assumed hospitals would succeed in reducing all-cause readmissions at about the same rate as reported in the research literature when they adopted CTI (35%) or Project RED (30%) (Kanaan 2009; Jack *et al*. 2009). Assuming that all payers adopt P4P, New York hospitals would have readmitted an estimated 1,000 to 2,000 fewer patients (depending on the intervention)—0.5 to 1% fewer readmissions than actually occurred in 2008. The hospitals that would find it cost-effective to implement Project RED were mostly small hospitals with relatively few stays; in contrast, three times as many hospitals would find it cost-effective to implement CTI. Consequently, statewide readmissions would have fallen less with the adoption of Project RED (by about 1,000 stays in 2007 and 2008) than with the adoption of CTI (by 2,000 stays), notwithstanding CTI's focus on a narrower range of diagnoses (Table V.4). Assuming that hospitals that invest in reducing readmissions in 2007 would continue that investment in 2008, the percentage reductions in readmissions would have been similar in both years.

TABLE V.4. Simulated Effects of Payment Incentives on Readmission Rates, 2007–2008

	NUMBER OF READMISSIONS (IN THOUSANDS)	CHANGE IN READMISSIONS	
		NUMBER (IN THOUSANDS)	PERCENTAGE
ACTUAL EXPERIENCE:			
2007	263.1	n/a	n/a
2008	273.6	n/a	n/a
PAY FOR PERFORMANCE:			
CARE TRANSITIONS INTERVENTION (CTI)			
2007	261.1	-2.0	-0.8%
2008	271.5	-2.0	-0.7%
PROJECT RED INTERVENTION			
2007	261.9	-1.2	-0.5%
2008	272.3	-1.3	-0.5%
EPISODE-BASED PAYMENTS:			
CARE TRANSITIONS INTERVENTION (CTI)			
2007	244.4	-18.7	-7.1%
2008	254.3	-19.2	-7.0%
PROJECT RED INTERVENTION			
2007	220.1	-43.0	-16.3%
2008	228.9	-44.7	-16.3%

SOURCE: Mathematica Policy Research analysis of New York hospital discharge data.

NOTE: Hospitals that implemented the intervention in 2007 are assumed to continue implementation in 2008.

Because many more hospitals would respond to episode-based payments, the reduction in readmissions in 2007 and 2008 would have been substantially greater. Depending on the intervention, the reduction in readmissions under episode-based payments would have ranged from 19,000 fewer readmissions (7%) if hospitals had considered adopting CTI, to 45,000 fewer readmissions (16%) if they had considered adopting Project RED.

EFFECT ON HOSPITAL PAYMENTS

Reducing the number of readmissions generates cost savings—but depending upon the payment method used, either payers or hospitals may realize those savings in the short term. When hospitals are paid FFS, payers immediately capture the cost savings from fewer readmissions. Unless modified (for example, by P4P) FFS offers hospitals no financial reason to help patients avoid readmission. In contrast, when hospitals assume full risk (as would occur with episode-based payments) they capture nearly all of the short-term cost savings from fewer readmissions—although payers benefit over time as payments are benchmarked to lower readmission rates.

In this section, we report estimates of the savings that accrue to the payers for hospital care. Both types of payment reforms—P4P and episode-based payments—reduce hospital payments as a result of changes in the number of readmissions and the level of payment per admission. However, the relative impact of reduced readmissions versus reduced payment per admission is different, depending on the payment method.[13]

Under P4P, total payments to hospitals in 2008 would have been reduced by $200 million, or approximately 1%. Most hospitals would not have faced payment reductions and among those that did, relatively few hospitals would have acted to reduce readmissions **(Table V.5)**. Thus, reductions in payments would have been more likely a result of lower payment rates to hospitals with excess readmissions than to fewer readmissions.

Under episode-based payments, total payments would have fallen $188 to $286 million (0.8 to 1.2%). Many more hospitals would have acted to reduce readmissions (and the number of readmissions would fall significantly), but payers would not have captured the cost savings associated with lower utilization immediately. In the first year of implementation (2007), immediate payer savings would have been due entirely to spillover effects on the number of readmissions, as fewer readmissions returning to hospitals other than the discharging hospital produced fewer new episodes overall (estimates not shown).[14] In the next year (2008), episode-based payments would have been re-based to the lower 2007 readmission rates, resulting in larger savings for payers.

[13] Some of the difference in impact was related to when the reform was assumed to take effect. P4P was assumed to begin in 2008, based on readmissions experience in 2007. Hospitals that chose to adopt Project RED or CTI in 2007 did so in order to influence the size of their payment reductions in 2008. In contrast, episode-based payment reform could have been implemented immediately, and we modeled it effective in 2007, with effects observed in both 2007 and 2008.

[14] Readmissions to another hospital are treated as a new episode payable to the second hospital, as the administrative complexity of attributing a single episode payment to multiple hospitals is too high. When total readmissions decline, the number of spillover readmissions that create a new episode of care also decline, reducing payer costs. If an episode-based payment system were implemented that did not recognize readmissions to a different hospital as a new episode, all immediate payer savings would disappear.

TABLE V.5. Simulated Payment Reform Effects on Hospital Payments, 2008

	TOTAL PAYMENTS FOR ALL ADMISSIONS ($ BILLIONS)	SIMULATED CHANGE IN TOTAL PAYMENTS	
		DOLLARS ($ MILLIONS)	PERCENT CHANGE
Actual experience	$23.4	n/a	n/a
PAY FOR PERFORMANCE			
CTI	$23.2	-$200.3	-0.9%
Project RED	$23.2	-$205.3	-0.9%
EPISODE-BASED PAYMENTS			
CTI	$23.2	-$187.5	-0.8%
Project RED	$23.1	-$285.5	-1.2%

SOURCE: Mathematica Policy Research analysis of New York hospital discharge data.

DIRECT PAYMENT FOR CLINICAL INTERVENTIONS

The results reported above demonstrate important aspects of payment incentives to reduce readmissions. P4P payment incentives overlaid on FFS payments may affect practices in relatively few hospitals—although the P4P approach that we modeled would have resulted in at least 1,000 fewer readmissions per year and lower payments across the board to hospitals with above-average readmission rates. In contrast, episode-based payment could achieve significant changes in hospital practices, with tens of thousands fewer readmissions per year; however, payers would retrieve savings more slowly, as payment rates are benchmarked to lower rates of readmission. Regardless of the payment incentives, hospitals that respond to either payment reform would be more likely to choose an intervention that focuses on high-cost, high-readmission conditions, even when a program aimed at a broader set of conditions may have a larger effect on readmission rates.

Under both payment incentives that we modeled, payer savings were less than what would have occurred had more hospitals been induced to change, or if payers could have immediately retrieved all the savings from reduced readmissions. Payers might achieve both greater change and immediate savings simply by paying hospitals directly to implement evidence-based interventions. Some payers—those with enrollees that experience high rates of readmission—might find this strategy more cost-effective than others, and the intervention could easily be targeted to patients associated with particular payers.

The potential effect of a direct-payment strategy on readmissions and total payments is reported in Table V.6 for each payer type—Medicare, Medicaid, and commercial payers (assuming uniform implementation among all payers). With direct payment for CTI or Project RED interventions, all targeted hospitals would implement the intervention. Therefore, readmissions would be reduced as much or more than with payment incentives, and net savings to payers would be much larger.

For example, New York's Medicaid program might have spent $19.9 million to implement Project RED in all hospitals for all applicable index stays, for a net saving of $116 million in 2008. A more targeted approach, paying directly for either intervention in the largest quartile of hospitals (based on number of admissions) could have yielded as much as $92 million in savings.

TABLE V.6. Estimated Net Benefit of Direct Payment for CTI and Project Intervention Costs by Payer, 2008

	PAYMENTS FOR INTERVENTION TARGETED TO:		
	ALL HOSPITALS ($ MILLIONS)	LARGEST 50 PERCENTAGE OF HOSPITALS ($ MILLIONS)	LARGEST 25 PERCENTAGE OF HOSPITALS ($ MILLIONS)
MEDICARE			
CTI			
Intervention cost	$51.7	$45.6	$33.4
Reduction in readmission costs with intervention	$183.1	$163.9	$118.2
Net reduction in cost	$131.4	$118.3	$84.8
PROJECT RED			
Intervention cost	$60.8	$50.9	$34.0
Reduction in readmission costs with intervention	$487.6	$428.3	$294.9
Net reduction in cost	$426.9	$377.4	$260.8
MEDICAID			
CTI			
Intervention cost	$9.9	$9.3	$7.7
Reduction in readmission costs with intervention	$33.7	$32.2	$27.6
Net reduction in cost	$23.9	$22.9	$19.8
Project RED			
Intervention cost	$19.9	$18.3	$14.6
Reduction in readmission costs with intervention	$135.6	$127.9	$106.5
Net reduction in cost	$115.7	$109.6	$91.9
COMMERCIAL INSURANCE DISCHARGES			
CTI			
Intervention cost	$16.5	$15.0	$11.7
Reduction in readmission costs with intervention	$32.8	$30.5	$24.2
Net reduction in cost	$16.3	$15.5	$12.4
PROJECT RED			
Intervention cost	$24.6	$20.9	$14.7
Reduction in readmission costs with intervention	$102.6	$92.5	$71.0
Net reduction in cost	$78.0	$71.5	$56.3

SOURCE: Mathematica Policy Research analysis of New York hospital discharge data.

NOTE: Hospital size is defined as total number of admissions by payer.

Payment Reform Simulations *(continued)*

Other payers also might achieve net savings by directly paying hospitals for interventions to reduce readmissions. Reflecting the higher rate of readmissions among Medicare beneficiaries, Medicare might have achieved even larger net savings than Medicaid, had it directly paid for evidence-based interventions to reduce readmissions. Medicare might have saved $427 million by paying for the Project RED in all New York hospitals, and $261 million if it targeted the largest hospitals. In the aggregate, commercial payers' savings would have comparable to those for Medicaid.

Summary and Concluding Remarks

Emerging efforts to reduce readmissions largely focus on payment incentives. This study investigated two such incentives, P4P and episode-based payments, which are broadly favored by health policy experts. While some payers—including New York's Medicaid program—have implemented P4P incentives to reduce hospital readmissions, Medicare is in the process of implementing episode-based payments to achieve the same end.

Our results suggest that either strategy would achieve fewer readmissions and lower costs for payers, but payment incentives may not be the most effective means to that end. Because P4P would assign all rewards from reduced readmissions to payers, relatively few hospitals have a sufficient financial incentive to undertake the direct and indirect costs of reducing readmissions. Conversely, episode-based payments would give hospitals a much stronger incentive to reduce readmissions, but payers would be able to retrieve most savings only over time. In either case, hospitals would be likely to respond narrowly—focusing on patients in diagnostic categories where both the likelihood and cost of readmissions are high—even when there are positive societal net benefits from more broadly targeting efforts to reduce readmissions.

It seems likely that payers can achieve better results—greater reduction in avoidable readmissions and greater cost savings—by paying hospitals directly to implement evidence-based interventions to reduce readmissions. To be most effective, public and private payers and hospitals would need to collaborate and agree on a set of strategies that would be feasible and effective for all payers. While hospitals could target interventions to participating payers (and not all payers need participate), any one hospital might find it inefficient or impossible to adopt different strategies for different payers.

Diverting from payment incentives to direct payment for reducing hospital readmissions would be a significant step, especially in light of the P4P program that New York's Medicaid program already has implemented. However, the prospect of both greater reduction in readmissions and greater payer savings from direct payment to hospitals to adopt evidence-based discharge procedures raises important questions about whether payers should instead rely on payment incentives for that purpose. This study demonstrates the need for greater clarity and discussion among payers and hospitals about how best to achieve the changes that are needed to reduce readmissions in New York.

References

Balaban, R. B., J. S. Weissman, P. A. Samuel, and S. Woolhandler. "Redefining and Redesigning Hospital Discharge to Enhance Patient Care: A Randomized Controlled Study." *Journal of General Internal Medicine*, vol. 23, no. 8, 2008, pp. 1228-1233.

Bernstein, J., D. Chollet, and S. Peterson. "Financial Incentives for Health Care Providers and Consumers." *Reforming Health Care*, Issue Brief no. 5, May 2010 (http://www.mathematica-mpr.com/publications/PDFs/health/reformhealthcare_IB5.pdf).

Bodenheimer, T. "Coordinating Care—a Perilous Journey through the Health Care System." *New England Journal of Medicine*, vol. 358, no. 10, 2008, pp. 1064-1071.

Boutwell, A. and S. Hwu. "Effective Interventions to Reduce Rehospitalizations: A Survey of the Published Evidence." Cambridge, MA: Institute for Healthcare Improvement, 2009.

Calkins, D. R., R. B. Davis, P. Reiley, R. S. Phillips, K. L. C. Pineo, T. L. Delbanco, and L. I. Iezzoni. "Patient-Physician Communication at Hospital Discharge and Patients' Understanding of the Postdischarge Treatment Plan." *Archives of Internal Medicine*, vol. 157, no. 9, 1997, pp. 1026.

Centers for Medicare & Medicaid Services. "Proposals for implementing quality of care during inpatient stays in acute care hospitals in the fiscal year 2011 notice of proposed rulemaking." Baltimore MD: CMS press release. April 19, 2010.

Coleman, E. A. and R. A. Berenson. "Lost in Transition: Challenges and Opportunities for Improving the Quality of Transitional Care." *Annals of Internal Medicine*, vol. 141, no. 7, 2004, pp. 533.

Coleman, E. A., C. Parry, S. Chalmers, and S. J. Min. "The Care Transitions Intervention: Results of a Randomized Controlled Trial." *Archives of Internal Medicine*, vol. 166, no. 17, 2006, pp. 1822.

Coleman, E. A., J. D. Smith, D. Raha, and S. Min. "Posthospital Medication Discrepancies: Prevalence and Contributing Factors." *Archives of Internal Medicine*, vol. 165, no. 16, 2005, pp. 1842.

Dudas, V., T. Bookwalter, K. M. Kerr, and S. Z. Pantilat. "The Impact of Follow-Up Telephone Calls to Patients After Hospitalization." *The American Journal of Medicine*, vol. 111, no. 9, 2001, pp. 26-30.

Feeney. D. "Modifications to the Maryland Hospital Preventable Readmissions Draft Recommendations." Memo submitted to the Health Services Cost Review Commission. January 2011.

Forster, A. J., H. J. Murff, J. F. Peterson, T. K. Gandhi, and D. W. Bates. "The Incidence and Severity of Adverse Events Affecting Patients After Discharge from the Hospital." *Annals of Internal Medicine*, vol. 138, no. 3, 2003, pp. 161.

Jack, B. W., V. K. Chetty, D. Anthony, J. L. Greenwald, G. M. Sanchez, A. E. Johnson, S. R. Forsythe, J. K. O'Donnell, M. K. Paasche-Orlow, and C. Manasseh. "A Reengineered Hospital Discharge Program to Decrease Rehospitalization." *Annals of Internal Medicine*, vol. 150, no. 3, 2009, pp. 178.

Kripalani, S., A. T. Jackson, J. L. Schnipper, and E. A. Coleman. "Promoting Effective Transitions of Care at Hospital Discharge: A Review of Key Issues for Hospitalists." *Journal of Hospital Medicine*, vol. 2, no. 5, 2007, pp. 314-323.

Kripalani, S., F. LeFevre, C. O. Phillips, M. V. Williams, P. Basaviah, and D. W. Baker. "Deficits in Communication and Information Transfer between Hospital-Based and Primary Care Physicians." *JAMA: The Journal of the American Medical Association*, vol. 297, no. 8, 2007, pp. 831.

Lake, T. K. Stewart, P. Ginsburg. "Lessons from the Field: Making Accountable Care Organizations Real. Washington DC: National Institute for Health Care Reform. Research Brief No 2. January 2011.

Leatherman, S., D. Berwick, D. Ilies, L. Lewin, F. Davidoff, T. Nolan, and M. Biscognano. "The Business Case for Quality: Case Studies and Analysis." *Health Affairs*, Vol. 22, No. 2, 2003, pp. 17-30

References *(continued)*

Miller, H. "From Volume to Value: Better Ways to Pay for Health Care." *Health Affair*s, vol. 28, No. 5, September 2009, pp. 1418-1428.

Minott, J. "Reducing Hospital Readmissions." 2008. Accessed July 27, 2010 at http://www.academyhealth.org/files/publications/Reducing_Hospital_Readmissions.pdf.

Moore, C., J. Wisnivesky, S. Williams, and T. McGinn. "Medical Errors Related to Discontinuity of Care from an Inpatient to an Outpatient Setting." Journal of General Internal Medicine, vol. 18, no. 8, 2003, pp. 646-651.

Naylor, M., D. Brooten, R. Jones, R. Lavizzo-Mourey, M. Mezey, and M. Pauly. "Comprehensive Discharge Planning for the Hospitalized Elderly." *Annals of Internal Medicin*e, vol. 120, no. 12, 1994, pp. 999.

Naylor, M. D., D. Brooten, R. Campbell, B. S. Jacobsen, M. D. Mezey, M. V. Pauly, and J. S. Schwartz. "Comprehensive Discharge Planning and Home Follow-Up of Hospitalized Elders." *JAMA: The Journal of the American Medical Association*, vol. 281, no. 7, 1999, pp. 613.

Naylor, M. D., D. A. Brooten, R. L. Campbell, G. Maislin, K. M. McCauley, and J. S. Schwartz. "Transitional Care of Older Adults Hospitalized with Heart Failure: A Randomized, Controlled Trial." *Journal of the American Geriatrics Society*, vol. 52, no. 5, 2004, pp. 675-684.

Phillips, C. O., S. M. Wright, D. E. Kern, R. M. Singa, S. Shepperd, and H. R. Rubin. "Comprehensive Discharge Planning with Postdischarge Support for Older Patients with Congestive Heart Failure." *JAMA: The Journal of the American Medical Association*, vol. 291, no. 11, 2004, pp. 1358.

Pittsburgh Regional Health Initiative. "PHRI Readmission Reduction Guide: A Manual for Preventing Hospitalizations" Pittsburgh, PA: PHRI. 2011.

Pronovost, P., B. Weast, M. Schwarz, R. M. Wyskiel, D. Prow, S. N. Milanovich, S. Berenholtz, T. Dorman, and P. Lipsett. "Medication Reconciliation: A Practical Tool to Reduce the Risk of Medication Errors." *Journal of Critical Care*, vol. 18, no. 4, 2003, pp. 201-205.

Rosenthal, M. "Beyond Pay-for-Performance: Emerging Models of Provider Payment Reform" *New England Journal of Medicine*, Vol. 359, September 18, 2008, pp. 1197-1200.

Rosenthal, M., R. Frank, L. Zhonghe, and A. Epstein. "Early Experience with Pay for Performance." *JAMA: The Journal of the American Medical Association*, vol. 294, no. 14, October 12, 2005, pp. 1788–1793.

Rosenthal, M., B. Landon, S. Normand, R. Frank, and A. Epstein. "Pay for Performance in Commercial HMOs." *The New England Journal of Medicine*, vol. 355, no, 18, November 2, 2006, pp. 1895–1902.

Technical Appendix

The following sections describe the methods used in this report to identify and count hospital readmissions in New York State from 2006 to 2008 among adults aged 18 or older, and to simulate the potential impacts of payment strategies designed to reduce readmissions.

SOURCES OF DATA

The Statewide Planning and Research Cooperative System (SPARCS) inpatient hospital discharge databases for 2006, 2007, and 2008 were the primary data sources for this study. These databases are compiled from the discharge data that hospitals in New York report annually to the Department of Health. Each discharge record includes information on patient characteristics (such as age and gender), the reason for the admission (including diagnoses and procedures performed), the hospital charges associated with the stay, and the expected primary payer. Restricted data elements include a unique patient identifier (an encrypted hash of first name, last name, and social security number), admission date, and discharge date.

All discharges for patients who were under age 18 or residents of a state other than New York were excluded from the analysis. In addition, we discovered a small number of records for patients with overlapping stays at different hospitals; because patient identifiers associated with these stays were for separate individuals who could not be reliably identified, all stays associated with those patient identifiers were excluded from the analysis. Finally, because the unique patient identifier is withheld on discharge records where the patient is HIV-positive or admitted for an abortion procedure, those records also were excluded.

IDENTIFYING AND COUNTING READMISSIONS

We identified and flagged two types of readmissions in the SPARCS data: all-cause readmissions (that is, readmissions for any reason) and readmissions due to complication or infection. Each was flagged separately for two readmission windows: respectively, within 14 days and within 30 days of the initial (index) admission.

An index admission was defined as any inpatient hospital stay that might produce an avoidable readmission. Index admissions included all discharges to home or to nursing care, but excluded admissions where:

1) The patient was transferred to another acute-care hospital;

2) The patient died or left against medical advice; or

3) The original discharge was for a condition expected to result in readmission during the normal course of treatment, including major or metastatic malignancy, multiple trauma, or burns; rehabilitation; or pregnancy-related obstetric care prior to delivery.

Most admissions (90%) were classified as index admissions. In the case of transfers to another hospital, the stay at the first (transferring) hospital was ineligible to be an index admission but the stay at the second (receiving) hospital could be an index admission. Same-day readmissions

for the same condition were collapsed into one stay. Readmissions were themselves eligible to be counted as index admissions and evaluated for their own readmissions.

All-cause readmissions were defined as an admission to any hospital for any reason within 14 or 30 days of the discharge date for an index admission. Readmissions for complication or infection were defined as an admission to any hospital within 14 or 30 days of discharge from an index admission, where the diagnosis on the readmission was for stroke or anoxic brain damage; acute myocardial infarction; hypertension and hypotension; shock; vascular complications; respiratory complications; digestive complications; infection; pneumonia; device, implant, or graft complications; or procedure and medical care complications. These diagnoses are the same ones used by the Pennsylvania Health Care Cost Containment Council to identify readmissions due to complication or infection.[15]

Readmission rates were calculated as the percentage of all index admissions that resulted in a readmission.

CALCULATING COSTS

The SPARCS data contain information on hospital charges, not actual payments. To estimate payments to hospitals for all admissions and for readmissions, we multiplied reported charges for each stay by the hospital-specific cost-to-charge ratio (by year) reported in the Healthcare Cost and Utilization Project (HCUP) Cost-to-Charge Ratio Files. Produced by the Agency for Healthcare Research and Quality (AHRQ), these files contain hospital-specific information on how hospital costs relate to charges in each year, based on hospital accounting reports collected by the Centers for Medicare and Medicaid Services (CMS). Because national Medicare and Medicaid payments are roughly equal to or slightly lower than actual hospital costs, while commercial payment rates tend to be slightly higher, this method of estimating payments may overstate Medicare and Medicaid payments and understate commercial insurance payments.

DESCRIPTIVE STATISTICS

Statistics on readmission rates and costs were calculated for each hospital, and presented on an aggregate level by patient characteristic, admission type, hospital type, and primary expected payer. Readmissions were classified according to the characteristics of the index admission and not the readmission. In order to allow a run-out period to observe all readmissions, we identified index admissions occurring between January 1 and October 31 and then annualized the number and cost of readmissions.[16]

Admission type was based on the All-Patient Refined Diagnosis Related Group (APR-DRG) on the discharge record. All APR-DRGs are classified as either medical or surgical stays; we further classified all APR-DRGs with a Major Diagnostic Category (MDC) of 14 (pregnancy, childbirth and

[15] See: http://www.phc4.org/reports/hpr/08/docs/hpr2008technotes.pdf, Table B.

[16] Some stays occurring in December are captured in the 2009, rather than 2008, discharge data. This occurs for any stay that begins in December but concludes in January. In order to avoid a downward bias in readmission rates, we measured index admissions through the end of October, allowing for a 30-day run-out period through the end of November.

puerperium) as "maternity," and those with an MDC of 19 or 20 (mental diseases and disorders, and alcohol/drug use or induced mental disorders, respectively) as "behavioral health" stays.[17]

Hospital type was based on information in Thomson-Reuters' *Profiles of U.S. Hospitals, 2008*. Each hospital was classified as not-for-profit or other (including government and investor-owned), by teaching status, and as a disproportionate share hospital or not. Major teaching hospitals were those with 25 or more full-time residents; minor teaching hospitals were those with fewer than 25 residents; and non-teaching hospitals were those without a residency program. Disproportionate share hospitals were those eligible for Medicare DSH payments; in general, these hospitals serve a high proportion of Medicaid patients and/or Medicare patients eligible for Supplemental Security Income.

EXPECTED READMISSION RATES

Following the indirect standardization method used by Jencks *et al*. (2009), we calculated an expected readmission rate for each hospital for both all-cause readmissions and readmissions related to infections and complications. These measures represent the rate of readmissions that would have occurred had the hospital experienced the statewide average readmission rate, respectively for any cause or for infections and complications.

To determine each hospital's expected readmission rate, the number of index admissions for each APR-DRG was multiplied by the statewide average readmission rate for that condition and severity level, and then summed across APR-DRGs to arrive at the total number of expected readmissions given the hospital's case mix. Any APR-DRG with fewer than three index admissions during the year was excluded from the calculation of hospital-specific expected and actual readmission rates.

SIMULATION OF HOSPITAL BEHAVIOR UNDER PAYMENT REFORM

To estimate the change in hospitals' net revenues, we simulated the effect of payment reforms on hospital decisions to adopt interventions that would reduce readmission rates. We assumed that hospitals would attempt to maximize total revenues net of the sum of (a) the revenue loss associated with lower readmissions, and (b) the cost of an intervention to reduce the probability of readmission. The simulations assumed there were no second-order effects—specifically, that hospitals would not attract new patients by reducing the probability of readmission following an index stay.

Two hospital payment reform models were simulated: **(a)** a cost-saving pay-for-performance model; and **(b)** an episode-based payment model. We assumed that all payers adopted the same payment reform simultaneously. Under each payment reform, we further assumed that hospitals would consider two alternative interventions, CTI or Project RED (for a total of four simulations).

[17] See: http://www.hcup-us.ahrq.gov/db/nation/nis/APR-DRGsV20MethodologyOverviewandBibliography.pdf.

Cost-Saving Pay-for-Performance (P4P)

The P4P program that we simulated would reduce payment per admission for hospitals with all-cause readmission rates that exceeded their expected rates; other hospitals (with all-cause readmission rates equal to or less than their expected rates) would receive no change in their payment rates. In operation, P4P would adjust payments in a follow-up year based on measurement of benchmark readmission rates in a prior year. We modeled a program that measured hospital performance in 2007 against benchmarks measured in 2006, and adjusted payment in 2008. Hospitals would then choose to intervene (or not) to reduce readmissions in 2007 in order to avoid a payment reduction in 2008.

The P4P simulation assumed that hospitals will act to maximize total revenue net of program implementation costs:

$$\sum_{d=1}^{all\ DRGs} \left(\sum_{i=1}^{all\ admits} \left(P_{i,d}^{new} - I_d \right) \right)$$

WHERE

$P_{i,d}^{new}$ = The revised payment for an admission for patient *i* with condition *d*

I_d = The cost of the intervention for each admission of a patient with condition *d*

The model assumed that a hospital would invest in a care intervention if it expected its payment reduction in 2008 to exceed its cost of change in 2007. The cost of change was measured as the cost of the care intervention in 2007 (direct cost) plus the hospital's expected revenue loss in 2007 from fewer readmissions (indirect cost). The cost of the intervention was estimated as the median cost of the care intervention among all hospitals in a geographic area (presented in report Tables IV.1 and IV.2). We assumed that each hospital anticipated a 30% reduction in the rate of readmission for the targeted conditions (to itself or to any other hospital) if it implemented the Project RED intervention, and a 35% reduction if it implemented the Care Transitions Intervention.

The revised payment per admission based on each hospital's readmission performance was defined as:

$$P_i^{new} = P_i^{old} \times AF_h$$

WHERE

P_i^{new} = The revised payment for an admission for patient *i*

P_i^{old} = The current payment for an admission of patient *i*

AF_h = Adjustment factor for the hospital, based on the hospital's all-cause 30-day readmission rate to any hospital following an index hospitalization for all DRGs, and

$$AF_h = 1 - \frac{EXCSP_h}{TOTP_h}$$

WHERE

$EXCSP_h$ = Aggregate payments for excess readmissions to any hospital following an index admission to hospital *h*

$TOTP_h$ = Aggregate payments for all admissions to hospital *h* during year

Aggregate payments for excess readmissions were measured as the average payment for all readmissions following an index admission for a specific DRG to hospital *h* multiplied by the difference between the hospital's actual and expected number of readmissions for that DRG, summed across all DRGs.

Episode-Based Payment

With episode-based payment, a hospital's revenue reflects the number of initial index admissions but not the number of readmissions. Consequently, readmissions represent unreimbursed costs to the hospital. As with the pay-for-performance simulations, the episode-based payment simulations assumed that each hospital would maximize its net revenue, measured as total revenue minus the cost of implementing an intervention (direct cost) and the cost of unreimbursed hospitalizations (indirect cost):

$$\sum_{d=1}^{\text{all DRGs}} \left(\sum_{i=1}^{\text{all index admits}} \left(P_{i,d}^{new} - I_d\right) - R_d \right)$$

WHERE

P_i^{new} = The new episode-based payment for an initial index admission for patient *i* with condition *d*

I_d = The cost of the intervention for each patient with condition *d*

R_d = The unreimbursed cost of readmissions for condition *d*, and

$$R_d = \sum_{i}^{\text{all readmits}} P_i^{old}$$

WHERE

P_i^{old} = The current expenditure for a readmission for patient *i* with condition *d*

A hospital would intervene to reduce readmissions only if its expected total revenue minus the costs of the intervention and (fewer) unreimbursed readmissions was greater than its expected total revenue minus the cost of current readmissions (which would be unreimbursed).

The expected frequency of readmissions in a hospital episode of care was calculated using the statewide mean readmission rate among all hospitals in the prior year for that APR-DRG and severity level.[18] Any index admission that was not a readmission counted as the start of a new episode for the hospital. The episode-based payment was set equal to the recorded payment amount on the record plus the expected value of readmissions:[19]

$$P_i^{new} = P_i^{old} \times (1+Pr_d)$$

WHERE

P_i^{new} = The new, episode-based payment for an index admission for patient *i*

P_i^{old} = The current per-discharge payment for an index admission for patient *i*

Pr_d = Expected probability of one or more readmissions to the same hospital based on the DRG of the initial index admission

A readmission to another hospital was regarded as the start of a new episode. That is, we assumed that episode-based payments do not hold one hospital accountable for readmissions to another hospital.[20]

[18] Some episode based payment systems develop benchmark payment amounts based on the estimated cost of care meeting evidence-based guidelines. This approach would be beyond the scope of this simulation exercise.

[19] This formulation ensures that payments for an initial index admission are set such that a hospital is held harmless when its actual readmission rate equals the expected readmission rate. Payers could choose other levels of payment for an initial admission. For instance, setting the payment for an initial index admission equal to current payment would leave all hospitals except those with no readmissions worse off.

[20] A cost-neutral system of episode-based payments that accounts for readmissions to any hospital would be very complex to administer. In order to pay a hospital that accepted another (index) hospital's readmission, it would be necessary to transfer funds from the index hospital that received the initial episode payment. In addition, an episode-based payment to one hospital (for example, a small community hospital) might not support payment for readmission to another (for example, an urban teaching hospital). Consequently, to operate a cost-neutral system of episode-based payments accounting for all-hospital readmissions would at least require a system of inter-hospital accounting and reconciliation would be administratively cumbersome, and depending on readmission patterns, it might be altogether infeasible.

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