Potentially Preventable Readmissions in Rhode Island

Prepared for the Rhode Island Office of the Health Insurance Commissioner and the Rhode Island Executive Office of Health and Human Services

April 28, 2014

Document Version: 3.0 (April 2014).

Notes to the Reader

All results involving All Patient Refined Diagnosis Related Groups (APR-DRGs) and potentially preventable readmissions (PPRs) were produced using data obtained through the use of proprietary computer software created, owned and licensed by the 3M Company. All copyrights in and to the 3M™ Software are owned by 3M. All rights reserved. 3M bears no responsibility for the use of its software in this study.

A companion document to this report provides supplementary tables. One set of three tables shows cross-tabulations of the analytical dataset by hospital and by payer. There is also a table showing data on potentially preventable readmissions for every APR-DRG.

The companion document is available at http://www.ohic.ri.gov/.

Table of Contents

Glossary of Acronyms

ACA	Affordable Care Act
A/E	Actual to expected
AHRQ	Agency for Healthcare Research and Quality
ALOS	Average length of stay
APCD	All payer claims database
APR-DRGs	All Patient Refined Diagnosis Related Groups. APR-DRGs are proprietary software created, owned and licensed by the 3M Company. All copyrights in and to the 3M™ Software are owned by 3M. All rights reserved.
ASO	Administrative services only
CSI-RI	Rhode Island's patient-centered medical home
CY	Calendar year
EMR	Electronic medical record
EOHHS	Rhode Island Executive Office of Health and Human Services
FFS	Fee for service
HARI	Hospital Association of Rhode Island
HEDIS	Healthcare Effectiveness Data and Information Set
MCO	Managed care organization
MH/SA	Mental health / substance abuse
OHIC	Rhode Island Office of the Health Insurance Commissioner
PPR	Potentially preventable readmissions

Letter of Transmittal

Kevin Quinn
Vice President
Payment Method Development
Government Healthcare
Solutions

Xerox State Healthcare LLC
34 N. Last Chance Gulch
Suite 200
Helena, MT, 59601

kevin.quinn@xerox.com
tel 406.457.9550

April 28, 2014

Dr. Kathleen C. Hittner
Office of the Health Insurance Commissioner
State of Rhode Island
1511 Pontiac Ave
Bldg. 69, Floor 1
Cranston, RI 02920

Elena Nicolella
Executive Office of Health and Human Services
State of Rhode Island
Louis Pasteur Building
57 Howard Avenue
Cranston, RI 02920

RE: Potentially Preventable Readmissions in Rhode Island

Dear Dr. Hittner and Ms. Nicolella:

Thank you for the opportunity to assist the Office of the Health Insurance Commissioner (OHIC) and the Executive Office of Health and Human Services (EOHHS) on this study of potentially preventable readmissions (PPRs) in the Rhode Island population. We hope that this report will help state agencies, hospitals, health plans, and other interested parties improve health care in Rhode Island. We present our results as a series of 11 findings, emphasizing information that would be useful in understanding and reducing PPRs. Each finding is specific to Rhode Island, substantial enough that changes in time period would be unlikely to affect its relevance, and buttressed by evidence from other states where appropriate.

This analysis makes use of the extensive dataset of 2010 utilization data that we created for the previous OHIC/EOHHS study, *Variation in Payment for Hospital Care in Rhode Island*.[1] That dataset was created with extensive cooperation from Rhode Island commercial insurers and hospitals, for which we remain grateful.

Kim Paull, OHIC Director of Analytics at the time, and Dr. Deidre Gifford, EOHHS Medical Director at the time, wrote Chapter 1, which summarizes the findings and discusses the implications for improving health care in Rhode Island. The overall analysis was performed by Kevin Quinn and Bud Davies from the Payment Method Development team at Xerox. We appreciate the assistance received from Jeff Gray, Rick Jacobsen, Kenyatta Joseph, Mikal Moore, Angela Sims, and Andrew Townsend.

This study could not have been performed without the assistance of 3M Health Information Systems. The PPR algorithm itself is a product of 3M, as are All Patient Refined Diagnosis Related Groups (APR-DRGs). In comparing the Rhode Island experience with benchmarks from the Florida all-payer dataset (see Appendix A), we recognize and appreciate the pioneering role played by the Florida Agency for Health Care Administration in

understanding readmissions. We also appreciate permission received from the Commonwealth Fund to republish Medicare readmission data from the Fund's very useful website, www.WhyNotTheBest.org. We emphasize that 3M, AHCA, and the Commonwealth Fund bear no responsibility for our analysis and findings.

This report, as well as the previous report on variation in payment to hospitals, is available at www.ohic.ri.gov.

I would like to thank you and your colleagues, especially Ms. Paull and Dr. Gifford, for your guidance and assistance throughout this project. Anyone with questions may feel free to contact me at 406.457.9550 or kevin.quinn@xerox.com.

Sincerely,

Kevin Quinn

Cc: Rick Jacobsen
Account Manager, Rhode Island
Xerox

1 Summary and Introduction

This chapter was written by the Rhode Island Office of the Health Insurance Commissioner and the Executive Office of Health and Human Services

1.1 Why This Study?

Hospital readmission rates are a key performance measure for hospitals and for health care systems more generally. Readmissions gained widespread attention as a quality indicator after a 2009 article in the New England Journal of Medicine showed that one-fifth of Medicare inpatients were readmitted within a month, with half of those not seeing a physician in the interim.[2] Medicare, several Medicaid programs, and various other payers now include financial incentives aimed at reducing readmissions. In Rhode Island, several significant initiatives are under way to eliminate unnecessary readmissions (Box 1.1.1).

Box 1.1.1

Care Improvement Efforts in Rhode Island

- Many hospitals have adopted the Healthcentric Advisors Safe Transitions program and joined national readmission reduction organizations
- Medicare penalizes hospitals for certain types of common readmissions
- Value-based payments that reward excellent care are growing
- The state has invested in communication and data systems to track readmissions

In order to understand patterns of readmission and to identify risk factors for readmission, the Office of the Health Insurance Commissioner (OHIC) and Executive Office of Health and Human Services (EOHHS) commissioned this study. It examines how many hospitalizations in 2010 were followed by another hospitalization within 15 days that was potentially preventable. The data show that 6.3% of hospitalizations were followed within 15 days by a potentially preventable readmission (PPR), pointing to a need for system-level transformation. These 4,076 readmissions represent significant events for patients and their families, and millions in potentially avoidable costs to the health care system.

While not all readmissions are clinically preventable – for instance, an admission for a broken arm following a stay for pneumonia – many may be avoidable through improvements in the way care is coordinated and managed immediately after a hospital discharge. Reasons to infer that readmissions are unnecessarily frequent include: substantial variation among hospitals and states[3]; estimates that 80%-90% of readmissions are unplanned[4]; the finding in this and other studies that readmission risks peaks shortly after discharge; and reductions of readmission rates of 30% to 50% in randomized, controlled intervention trials.[5]

A 2011 survey of 43 articles on reducing readmissions offered a taxonomy of 12 interventions in three domains: pre-discharge, such as medication reconciliation and scheduling follow-up appointments; post-discharge, such as follow-up phone calls and timely communication with the primary care provider; and “bridging” interventions such as patient-centered discharge instructions and provider continuity.[6] For Rhode Island, Box 1.1.1 lists some of the efforts now under way to improve care. These efforts are not the province of hospitals alone. They require collaboration, coordination, and communication among the many spokes of the delivery system – hospitalists and specialists, primary care providers, discharge planners, medical home teams, health plan care managers, regulators and payers – and a commitment to keeping the patient at the hub.

This study is based on a uniquely useful dataset that was created for an earlier study on variation in payment to hospitals.[7] Because this study includes data for patients covered by commercial payers, Medicaid fee-for-service, Medicaid managed care, and Medicare managed care, it provides a statewide perspective not limited to a particular payer, hospital, or clinical condition. To measure readmissions, the study uses the potentially preventable readmission (PPR) approach developed by 3M Health Information Systems and also applied in Florida, Illinois, Maryland, New York, and Utah. Although the 2010 dataset pre-dates recent efforts to reduce readmissions, the discussion of results in Chapter 3 emphasizes findings that echo those from other studies and remain relevant today in Rhode Island.

1.2 Eleven Findings

Results are presented as a series of 11 findings, numbered in order of discussion within Chapter 3.

3.1: 6.3% of patients had a potentially preventable readmission. One in 15 patients had a PPR within 15 days. That is, of 51,739 index admissions, 3,238 were followed by at least one PPR (a "PPR chain"). Patients who had a PPR were often at risk for additional PPRs within subsequent 15-day periods. Overall, there were 4,076 PPR stays.

3.2: Results were similar to those from other states. As a general statement, PPR rates by care category tend to be similar from state to state. For example, PPR rates for mental health and substance abuse (MH/SA) conditions tend to be relatively high while those for obstetric conditions tend to be relatively low.

3.3: About two-thirds of readmissions were to the same hospital. This proportion varied by care category. For example, same-hospital readmissions were less common for MH/SA patients but more common for surgical patients.

3.4: The risk of a PPR peaked two days after discharge. This finding, which echoes similar studies elsewhere, implies that efforts to reduce PPRs should focus on the immediate post-discharge period.

3.5: PPRs represented about 7% of payments. Although not all PPRs are preventable, fewer readmissions would reduce the cost of care and improve patient outcomes.

3.6: Recurrence or continuation of the original condition were important reasons for PPRs. Almost half of all PPRs represented a recurrence or continuation of the original condition – 24% for a MH/SA condition and 20% for a medical condition. Another 34% were medical admissions followed by a possibly related acute condition, such as heart failure followed by septicemia. Surgical complications represented only 2% of PPRs.

3.7: PPR rates varied widely by reason for admission. Among common conditions, those with notably high PPR rates included bipolar disorders (11.7%), major depression (12.5%), heart failure (11.4%), and major bowel procedures (10.3%). Those with notably low PPR rates included vaginal deliveries (1.0%), cesarean deliveries (1.3%), knee replacements (2.4%), and uterine procedures for non-malignancies (2.5%).

3.8: Severity of illness affected the risk of readmission. For most medical and surgical conditions, there was a clear tendency for PPR rates to be higher for sicker patients. For pneumonia, for example, severity 1 patients had a PPR rate of 4.5% while severity 3 patients had a PPR rate of 12.3%.

3.9: Presence of a MH/SA comorbidity and possibly age affected PPR risk. For medical and surgical patients, the presence of a MH/SA comorbidity roughly doubled readmission risk, echoing findings from other states. Patient age may also have had an effect on PPR risk, as suggested by evidence from other states.

3.10: PPR rates tended to be higher for Medicaid patients. After adjusting for reason for admission, severity of illness, MH/SA, and patient age, Medicaid patients still tended to have higher PPR rates than commercial and Medicare managed care patients.

3.11: PPRs represented about 60% of all readmissions. The PPR algorithm counts roughly 60% of readmissions as "potentially preventable." Patients with metastatic cancer are one example of readmissions that are considered not potentially preventable.

An appendix to this report also shows how PPR comparisons across sub-populations – e.g., by hospital – can be made in a way that adjusts for differences in casemix.

Supplementary tables – in a separate document available at www.ohic.ri.gov – provide additional detail on the analytical dataset and results for every APR-DRG.

1.3 Focus on Mental Health and Substance Abuse Disorders

An important finding for Rhode Island is that patients with certain diagnoses – including mental health and substance abuse disorders – are at high risk for potentially preventable readmissions (Table 1.3.1). Indeed, bipolar disorder and major depression ranked No. 1 and No. 2 in total PPRs. This may surprise readers who are more familiar with Medicare's efforts to measure readmissions, which have focused on heart failure, pneumonia, and heart attack. Readmissions for heart failure, in particular, have been the subject of extensive study. To be sure, heart failure is a major concern, ranking No. 3 in this analysis. But bipolar disorder and major depression rank higher. This result echoes similar findings from Florida, New York, and a nationwide study.[8] Though behavioral health patients represent a relatively small portion of total spending, their care patterns and readmission rates represent a prime opportunity for intervention.

With regard to follow-up appointments after hospitalization, managed care organizations and other insurers routinely collect and report such information for the Healthcare Effectiveness Data and Information Set (HEDIS) datasets. In the Medicaid managed care program, 64% of individuals hospitalized for a mental illness in 2012 received a follow-up visit within seven days of discharge and 81% within 30 days.[9] The 36% of individuals discharged from the hospital who did not have outpatient follow-up within seven days represent an opportunity to improve care coordination and avoid unnecessary complications.

Patients with behavioral health conditions are particularly vulnerable to readmission in a fragmented, delivery system. Statewide studies and reports have documented the characteristics of the behavioral health care system that may hinder coordinated care. For example:

- Focus groups from the 2013 Community Health Needs Assessment, led by the Hospital Association of Rhode Island (HARI), noted the following challenges: continued stigma of MH/SA disorders and denial that treatment is needed; limited availability of clinical resources for certain populations; patient difficultly navigating the system and juggling multiple providers; payment incentives that do not optimize the balance between prescription medications and other forms of therapy; and the high costs in time and money of receiving services.

Table 1.3.1
Findings Related to Mental Health and/or Substance Abuse Conditions

Finding	Section
11.8% of patients hospitalized for a MH/SA condition had a potentially preventable readmission within 15 days. For all other categories together, the rate was 5.7%.	3.1
Once readmitted, these patients were more likely to be readmitted again. Their number of admissions per "PPR chain" was 1.52, compared with 1.20 for all other categories together.	3.1
Other states also show MH/SA PPR rates substantially higher than those of other care categories.	3.2
MH/SA patients were less likely to be readmitted to the same hospital (45%) than other care categories (73%).	3.3
Total payments for MH/SA potentially preventable readmissions were about $11 million in 2010, not counting payments to physicians and other providers and not counting MH/SA PPRs for patients not included within this study.	3.5
94% of potentially preventable MH/SA readmissions were also MH/SA hospitalizations.	3.6
Bipolar disorder, major depression, and schizophrenia ranked No. 1, No. 2 and No. 5 in terms of total PPRs.	3.7
For medical and surgical inpatients, presence of a MH/SA comorbidity roughly doubled the risk of a PPR.	3.9
MH/SA patients with Medicaid coverage were at a higher risk of a PPR than MH/SA patients with other coverage, even after adjusting for casemix differences.	3.10

Note: MH/SA = mental health/substance abuse.

- The focus group also noted that there are few MH/SA resources for children and adolescents or services on the weekends, and multiple challenges in the transition from acute to lower-intensity services.

- Rhode Island's Special Joint Commission to Study the Integration of Primary Care and Behavioral Health noted that state and federal regulations make it difficult to share necessary clinical information about MH/SA patients.[10] These regulations were designed to reduce the stigma associated with MH/SA disorders by protecting the confidentiality of a patient's MH/SA treatment data, among other goals. However, not all providers are aware that – with patient consent – these data can be shared among clinicians and in programs such as the Health Information Exchange.[11]

1.4 Improvements in Care in Rhode Island Since 2010

There is encouraging news. Since these 2010 data were collected, the Affordable Care Act has passed, Medicare has generated attention to readmissions with its Hospital Readmissions Reduction Program, and hospitals, health plans, and policy makers have taken steps to become champions of patient-centered care. Much work remains, but the following improvements since the study period are worth noting.

Provider-led Change

- **Safe Transitions.** This is a three-year Medicare-funded readmissions reduction program led by Healthcentric Advisors. Many providers have adopted the best-practices set. OHIC requires insurers to include Safe Transitions measures in their hospital contracts.
- **Hospital Engagement Network (HEN).** This national learning network has led to a 9% reduction in readmissions among Rhode Island's hospitals.
- **Re-Engineering the Discharge (RED).** This is a national program to develop a standard approach to discharge planning

Innovative Payment Practices

- These arrangements provide resources and incentives to improve coordination at hospital discharge.
- Rhode Island's patient-centered medical home ("CSI-RI") emphasizes excellent primary care to avoid hospitalizations.
- Several hospitals host bundled payment pilots. The state is home to a Medicare Accountable Care Organization. OHIC requires insurers to use innovative payment methods with hospitals.

Health Information Technology

- **CurrentCare.** The state's Health Information Exchange allows providers to confidentially share and see patient information, including electronic medical record (EMR) data and a patient's admission activity.
- **All Payer Claims Database.** This is a robust claims information system that will allow the monitoring of readmission trends. The APCD will address some of the limitations of this report by including nearly all admissions to Rhode Island hospitals and by frequently reporting recent data.
- **Provider Directory.** Rhode Island is building an authoritative database of physician contact information and organization affiliations to improve the patient handoff at discharge.

Government Programs and Policies

- Medicare instituted penalties for excessive readmissions for three common diagnoses (heart failure, heart attack, and pneumonia).
- Rhode Island Medicaid is partnering with Healthcentric Advisors to study and improve information transfer at the time of hospital discharge.
- Medicaid and the managed care organizations will also implement the medical home model, which deploys nurses to follow up with recently discharged patients.

1.5 Opportunities for Improvement

There is still work to be done. In a 2013 survey conducted by EOHHS and Healthcentric Advisors, 37% of hospitals said they always send information when a patient is discharged, but only 19% of physicians said they always have information about the hospital stay at the first office visit.[12] While 89% of providers stated that they want to receive information about pending laboratory studies at the time of hospital discharge, only 19% said they usually receive such information. This small survey indicates that there are likely significant opportunities to improve the process of communication between inpatient and primary care physicians at the time of hospital discharge. As well, this study identifies risk factors for potentially preventable readmissions that we hope will help focus efforts where they will be most effective (Table 1.5.1).

To sustain the momentum described in Section 1.4, the delivery system must continue to invest in successful programs and find new avenues for driving care improvement. Opportunities include the following.

Care Coordination Initiatives

- Continue payment reforms that support re-designed care transitions and improved care coordination. Such reforms may include expanding CSI-RI to include hospitals, specialists and MH/SA providers.
- Emphasize the needs of high-utilizers and individuals with MH/SA conditions to minimize disruptions and provide intensive wrap-around care.
- The ACA encourages state Medicaid agencies to explore value-based payment arrangements, which Rhode Island Medicaid will explore.
- OHIC will consider expanding the Hospital Contracting Conditions and Affordability Standards to provide sufficient regulatory authority and financial incentives to reduce readmissions.
- The Department of Health has identified eliminating unnecessary readmissions as a top priority and will champion surveillance, reporting, and provider communication efforts.

Table 1.5.1
Key Risk Factors for Potentially Preventable Readmissions

Risk Factor	Section
Patients who have had a recent PPR are at increased risk for additional PPRs.	3.1
Highest risk for potentially preventable readmission is two days after discharge.	3.4
Certain patients – such as those undergoing spinal procedures or being treated for liver disorders and psychiatric diseases – were at much higher risk of a potentially preventable readmission than others.	3.7
For a given condition, increased severity of illness made a PPR more likely.	3.8
Presence of mental health or substance abuse condition as a secondary diagnosis increased PPR risk.	3.9
Other things equal, PPR risk appears to be higher in the oldest age group.	3.9
Medicaid insurance status was associated with higher PPR risk.	3.10

Tools & Research

- Continue to build electronic tools such as Currentcare, EMRs, the Provider Directory, and the All Payer Claims Database to facilitate timely information transfer at the time of discharge and the statewide surveillance of readmission patterns.
- Conduct further research on the effect of length of stay and primary care provider relationships on readmission rates.
- Develop a standard process for using the Provider Directory to strengthen the connection between patients and their primary care providers, both to improve preventive care and to arrange a visit after discharge.
- Provide the necessary data, funding and legislative authority for the state's health planning groups to establish quantitative readmission targets, publish regular results on the state's progress, and recommend changes if needed.

2 Measuring Readmissions

2.1 Alternative Methods of Measuring Readmissions

Reducing readmissions has been described as "one of those magical occasions in which better care can both save money and improve outcomes."[13] Yet not all readmissions are preventable; they may be within the plan of care or reflect the progression of disease. "All cause" readmission rates, especially when calculated across many disparate clinical conditions, can be a crude measure of clinical care and health system performance.[14] At the same time, a tight focus on specific readmissions (e.g., those deemed avoidable by at least three reviewers[15]) misses the many sequelae when care is not as bad as medical error but falls well short of excellent. Readmission analyses differ in other aspects as well: same hospital or any hospital; within a "window" or 15, 30, or some other number of days; casemix adjusted or not; regression vs categorical; focus by population or focus by clinical condition. These approaches are not simply different methods of measuring the same thing. Rates can vary two-fold even on the same population, and performance rankings can vary sharply depending on the approach used.[16]

For this study, we chose the "potentially preventable readmission" approach developed by 3M Health Information Systems. It strikes a balance between the poles of all-cause and unambiguously preventable; is clinically specific; provides transparent and actionable results; is designed for an all-patient population; and has previously been used by Florida, Illinois, New York, Maryland, Utah, and the Medicare Payment Advisory Commission.[17] The PPR approach is described in the next section. Table 2.1.1 compares three common readmission approaches.

Table 2.1.1
Three Alternative Approaches to Measuring Readmissions

	AHRQ	Medicare	This Report
Population	All payers	Fee for service Medicare age 65 and over, as well as Veterans Health Administration patients	Commercial insurance, Medicare managed care, Medicaid fee for service, and Medicaid managed care
Results based on	Jan.-Nov. 2010, across 18 states	July 1, 2009, to June 30, 2012	CY 2010
Conditions included	All except infants, nonspecific conditions, fewer than 5,000 stays, or fewer than 500 readmissions	Heart attack, heart failure, pneumonia	All except newborns
Readmission window	30 days	30 days	15 days
Readmissions included	All causes	All causes	Only those with a plausible clinical connection to the index admission
Methodology	Categorical	Multivariate regression	Categorical
Methodology developed by	Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project	Yale University research center, for the Centers for Medicare and Medicaid Services (CMS)	3M Health Information Systems
Adjustments for casemix	Diagnosis (AHRQ Clinical Classification Software)	Age, gender, comorbidities at time of index admission, medical history within past year	Base APR-DRG, APR-DRG severity of illness, age group, presence of mental health/substance abuse comorbidity
Availability of results	www.ahrq.gov, Statistical Briefs 153 and 154	Hospital-specific data available at www.hospitalcompare.gov	This report

Note:
1. Source is Xerox, based on public information, especially M. Barrett, S. Raetzman and R. Andrews, *Overview of Key Readmission Measures and Methods.* HCUP Methods and Measures Series Report #2012-04. Rockville, MD: Agency for Healthcare Research and Quality, 2012.

2.2 Potentially Preventable Readmissions

The 3M PPR methodology is a computerized algorithm based on claims data submitted by hospitals.[18] Although complex, the algorithm is available for inspection by hospitals, health plans, and others with an interest in the details of its operation.[19]

In readmission studies, an "index admission" refers to an initial stay that may or may not be followed by one or more readmissions. Of the many ways to define and report readmissions, the simplest approach is to count all readmissions within a given time period. The 3M PPR approach used in this study is more sophisticated because it counts only readmissions for which a plausible clinical connection exists between the reason for the index admission and the reason for the readmission.

To put this approach into operation, the algorithm assigns every stay to an All Patient Refined Diagnosis Related Group (APR-DRG). There are 314 base APR-DRGs, which can be thought of as the reason for admission. Each base APR-DRG has four levels of severity. APR-DRG 139-1, for example, is assigned to a patient who has uncomplicated pneumonia. A patient assigned to APR-DRG 139-2 has both pneumonia and a significant comorbidity such as congestive heart failure. At the extreme, a patient assigned to APR-DRG 139-4 may have pneumonia with multiple organ failure.

When comparing the reason for admission with the reason for readmission, there are 314 x 314 = 98,596 possible pairs of base APR-DRGs. A 3M panel of clinicians made a judgment about whether each admission/readmission pair represented a PPR. For some pairs, additional factors were considered, including patient age or particular diagnoses and procedures within an APR-DRG. For each pair that counts as a PPR, the readmission is also classified by the clinical reason (e.g., recurrence or continuation of medical condition, surgical complication).

The 3M software categorically excludes several types of admissions and readmissions from the PPR analysis. Although some of these exclusions (such as a death) are excluded in almost every readmission measurement approach, the PPR methodology is more sophisticated in its efforts to exclude readmissions that are unlikely to be preventable. The major exclusions are as follows:

- Newborns, because the algorithm was not designed for the specific clinical needs of this population.
- Admissions for the medical (i.e., non-surgical) treatment of major metastatic cancer, major trauma, human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), and several less common conditions, because readmissions for these conditions were very likely to have been planned or unpreventable.
- Index admissions where the patient self-discharged against medical advice, because the hospital did not have an opportunity for discharge planning.[20]
- Index admissions during which the patient died.
- Index admissions where the patient was transferred to another acute care hospital. Because the receiving hospital has taken over care, the stay at the receiving hospital becomes the index admission.

Only admissions for acute care are considered for analysis. Treatment for sub-acute care, either to an acute care hospital for rehabilitation or convalescence, or to a sub-acute setting such as a nursing facility, was defined as "non-events," that is, neither an index admission nor a readmission.

Table 2.2.1 shows ten examples of whether specific admission/readmission scenarios would count as PPRs.

Readmissions may be measured within different "windows" of time. The shorter the window (e.g., seven days), the more likely a readmission was related to the hospital care. The longer the window is (e.g., 30 days or longer), the more likely a readmission may reflect deficiencies in patient compliance, in post-hospital care in the community, or in the patient's baseline health status. The 15-day readmission window chosen for this analysis was intended to strike a balance. For the purposes of comparison, Section 3.11 shows readmission rates over different periods.

PPR results are reported in terms of PPR rates, where the numerator equals the number of PPR chains and the denominator equals the number of index admissions at risk for a PPR. A "PPR chain" occurs when at least one PPR follows an index admission within 15 days. Any subsequent PPRs within 15 days of the first PPR are included within the count of total PPRs but do not affect the count of PPR chains. As a result, the PPR rate is less sensitive to heavy utilizers of care – so-called "frequent flyers" – than other readmission measures.[21] Because the denominator includes only patients at risk for a PPR, it excludes stays that are classified as "global exclusions." That is, patients for whom readmissions probably cannot be prevented are excluded from both the count of PPRs in the numerator and the count of at-risk index stays in the denominator. For similar reasons, the denominator excludes "non-events" such as stays where the patient left against medical advice.

Table 2.2.1
Examples of Potentially Preventable Readmission Logic

Patient	Clinical Scenario	Potentially Preventable Readmission?	Comment
1	Admission 1: 136 Resp. Malignancy Admission 2: 139 Pneumonia	No	Global exclusion (136)
2	Admission 1: 139 Pneumonia Admission 2: 136 Resp. Malignancy	No	Global exclusion (136)
3	Admission 1: 139 Pneumonia Admission 2: 340 Fracture of Femur	No	Readmission not clinically related
4	Admission 1: 139 Pneumonia Admission 2: 194 Heart Failure	Yes	Readmission possibly clinically related
5	Admission 1: 139 Pneumonia Discharge status: 07 Left against medical advice Admission 2: 139 Pneumonia	No	Patient left against medical advice
6	Admission 1: 139 Pneumonia Discharge status: 02 Transfer to another acute care hospital Admission 2: 194 Heart Failure	No	Transfers are not readmissions
7	Admission 1: 139 Pneumonia Transfer to another acute care hospital Admission 2: 139 Pneumonia Admission 3: 203 Chest pain	Admit 2: No Admit 3: Yes	Transfer does not preclude PPR
8	Admission 1: 225 Appendectomy Admission 2: 240 Digestive malignancy	No	Global exclusion (240)
9	Admission 1: 225 Appendectomy Admission 2: 097 Tonsil and Adenoid Procedures	No	Readmission not clinically related
10	Admission 1: 225 Appendectomy Admission 2: 251 Abdominal pain	Yes	Readmission possibly clinically related

Notes:

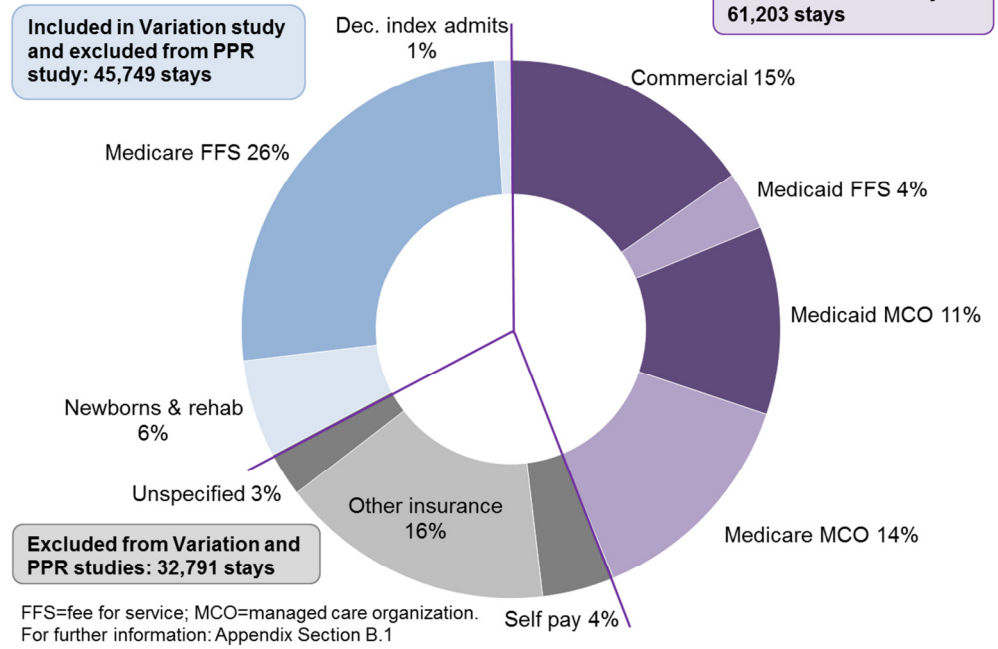
1. Assume all admissions in these examples occur within 15 days.
2. Source is Xerox, based on R.F. Averill, N.I. Goldfield, J.S. Hughes et al., *Potentially Preventable Readmissions Classification System Definitions Manual* (Wallingford, CT: 3M, October 2013).

2.3 The Dataset for the Analysis

This study makes use of the uniquely useful dataset from the previous study on payment variation, which included detailed utilization data for approximately 77% of all inpatient stays in Rhode Island in calendar year 2010.[22] Blue Cross Blue Shield of Rhode Island, United Healthcare and Tufts Health Plan provided claims data for their commercial large group, small group, administrative services only, individual, Medicare managed care, and Medicaid managed care lines of business. Neighborhood Health Plan did the same for its Medicaid managed care business. EOHHS provided Medicaid fee-for-service data. For Medicare fee-for-service, we used stay-level data from the Rhode Island Department of Health Discharge Dataset. The payment variation dataset comprised 106,951 inpatient stays. Data were unavailable for uninsured patients, workers' compensation, military health care, out-of-state plans, and some self-administered group plans.

This readmission study started from the payment variation dataset. However, the Medicare FFS data were unsuitable because they did not include the unique patient identifiers necessary to track readmissions.[23] We also excluded newborn stays and rehabilitation stays, for which the 3M PPR algorithm was not designed. Index stays in December 2010 were also excluded, because the dataset did not include any 2011 stays that might have been related to index admissions in December. The effect was that we counted index stays in an 11-month period and readmissions in that same period plus an additional one month of runout. The initial dataset for this study therefore comprised 61,203 stays, as shown in Chart 2.3.1. After PPR global exclusions and non-event stays were excluded, the analytical dataset comprised 55,815 stays. Appendix B provides more information on the data used in this study.

Chart 2.3.1
This Study Included about 44% of RI Hospital Stays



FFS=fee for service; MCO=managed care organization.
For further information: Appendix Section B.1

Tables 2.3.1, 2.3.2 and 2.3.3 show the dataset by care category, by payer, and by hospital, respectively.[24] A few points may be made:

- Total hospital charges were $1.7 billion, estimated hospital cost $692 million, and payment $721 million.
- Pediatrics (under age 18) represented 9% of stays and 10% of payment.
- Average casemix was 0.97, or about the same as average casemix nationwide.[25] Casemix varies considerably by care category, plan, and hospital. This means that any comparison across categories, plans, or hospitals is likely to be misleading unless casemix is adjusted for.
- The four largest hospitals – Rhode Island Hospital, Women & Infants, the Miriam Hospital, and Kent Hospital – accounted for about 60% of all stays and payments. (Although newborns were excluded from the dataset, the dataset for Women & Infants also included 7,595 stays for obstetric and other conditions.)

In our view, a categorical approach such as PPRs has many advantages, such as the ability to divide and subdivide data in numerous ways. For example, we will see the example of PPR rates for heart failure patients in the 65+ age group at specific hospitals (Appendix Section A.4). As the creation of sub-categories ("cells") becomes finer, however, the risk of over-interpretation becomes greater. We therefore discuss results only for cells that contain at least 40 index admissions, at least 5 PPR chains, and (if applicable) at least 5 expected PPR chains.[26] All other cells are considered low-volume.

Table 2.3.1
Overview of Initial PPR Dataset by Care Category

Care Category	Stays	Days	Charges	Est. Cost	Payment	Casemix	ALOS	Avg Chg / Stay	Avg Cost / Stay	Avg Pay / Stay
Pediatric										
Medical/surgical	3,770	12,802	$95,522,417	$36,041,432	$45,155,792	0.82	3.4	$25,338	$9,560	$11,978
MH/SA	1,746	20,507	$44,329,186	$31,256,079	$27,669,812	0.46	11.7	$25,389	$17,902	$15,848
Subtotal	**5,516**	**33,309**	**$139,851,602**	**$67,297,510**	**$72,825,605**	**0.71**	**6.0**	**$25,354**	**$12,200**	**$13,203**
Adult										
Cardiac	7,721	33,655	$306,926,760	$113,605,278	$107,410,146	1.29	4.4	$39,752	$14,714	$13,911
Orthopedics	5,256	22,381	$185,836,782	$74,345,118	$84,557,585	1.54	4.3	$35,357	$14,145	$16,088
Oncology	2,461	11,437	$79,808,647	$31,283,487	$32,836,268	1.17	4.6	$32,429	$12,712	$13,343
MH/SA	4,682	33,697	$87,348,710	$37,087,523	$40,271,794	0.48	7.2	$18,656	$7,921	$8,601
Other medical	20,950	103,839	$510,111,468	$198,217,462	$203,901,195	0.83	5.0	$24,349	$9,461	$9,733
Other surgical	5,981	38,212	$293,160,848	$114,702,073	$124,628,819	1.85	6.4	$49,015	$19,178	$20,837
Subtotal	**47,051**	**243,221**	**$1,463,193,216**	**$569,240,942**	**$593,605,808**	**1.09**	**5.2**	**$31,098**	**$12,098**	**$12,616**
Obstetrics	8,636	26,140	$135,828,218	$54,992,501	$54,730,043	0.42	3.0	$15,728	$6,368	$6,337
Total	**61,203**	**302,670**	**$1,738,873,036**	**$691,530,953**	**$721,161,456**	**0.97**	**4.9**	**$28,412**	**$11,299**	**$11,783**

Notes:
1. The initial dataset includes stays subsequently excluded as PPR global exclusions and non-events.
2. Estimated cost includes medical education.
3. MH/SA = mental health / substance abuse; ALOS = average length of stay.

Table 2.3.2
Overview of Initial PPR Dataset by Payer

Payer	Stays	Days	Charges	Est. Cost	Payment	Casemix	ALOS	Avg Chg / Stay	Avg Cost / Stay	Avg Pay / Stay
Commercial	21,396	88,462	$594,444,558	$236,083,966	$306,528,705	0.94	4.1	$27,783	$11,034	$14,326
Medicare MCO	19,099	103,853	$634,586,997	$243,879,255	$211,271,231	1.21	5.4	$33,226	$12,769	$11,062
Medicaid MCO	15,810	74,469	$355,674,790	$150,897,894	$138,162,140	0.67	4.7	$22,497	$9,544	$8,739
Medicaid FFS	4,898	35,886	$154,166,691	$60,669,839	$65,199,381	1.08	7.3	$31,475	$12,387	$13,311
Total	**61,203**	**302,670**	**$1,738,873,036**	**$691,530,953**	**$721,161,456**	**0.97**	**4.9**	**$28,412**	**$11,299**	**$11,783**

Notes:
1. The initial dataset includes stays subsequently excluded as PPR global exclusions and non-events.
2. Estimated cost includes medical education.
3. MH/SA = mental health / substance abuse; ALOS = average length of stay; MCO = managed care organization; FFS = fee for service.

Table 2.3.3
Overview of Initial PPR Dataset by Hospital

Care Category	Stays	Days	Charges	Est. Cost	Payment	Casemix	ALOS	Avg Chg / Stay	Avg Cost / Stay	Avg Pay / Stay
RI Hospital	15,552	77,799	$553,064,327	$206,123,560	$216,477,283	1.15	5.0	$35,562	$13,254	$13,920
Women & Inf	7,595	23,466	$146,447,584	$58,572,220	$58,099,804	0.50	3.1	$19,282	$7,712	$7,650
Miriam	6,964	30,920	$249,692,446	$84,431,011	$89,998,567	1.21	4.4	$35,855	$12,124	$12,923
Kent	6,946	34,149	$195,910,131	$70,710,332	$71,383,083	0.90	4.9	$28,205	$10,180	$10,277
St. Joseph	3,665	21,675	$85,440,798	$36,744,953	$35,123,720	0.92	5.9	$23,313	$10,026	$9,584
Roger Williams	3,372	14,659	$63,644,370	$34,244,156	$36,141,172	1.10	4.3	$18,874	$10,155	$10,718
Landmark	3,013	15,451	$83,017,086	$27,044,358	$28,082,887	1.01	5.1	$27,553	$8,976	$9,321
Memorial	2,642	11,121	$64,011,797	$28,427,518	$28,519,208	0.93	4.2	$24,229	$10,760	$10,795
Butler	2,431	17,741	$40,682,470	$19,115,319	$22,417,650	0.43	7.3	$16,735	$7,863	$9,222
South County	2,094	7,744	$38,010,183	$20,525,424	$19,912,277	0.93	3.7	$18,152	$9,802	$9,509
Newport	1,634	6,761	$23,761,990	$14,865,933	$13,373,739	0.81	4.1	$14,542	$9,098	$8,185
Westerly	978	3,898	$17,457,188	$9,089,583	$8,502,929	0.87	4.0	$17,850	$9,294	$8,694
Bradley	863	14,903	$28,708,562	$24,664,305	$19,487,926	0.45	17.3	$33,266	$28,580	$22,582
RI Subtotal	**57,749**	**280,287**	**$1,589,848,932**	**$634,558,671**	**$647,520,245**	**0.94**	**4.9**	**$27,530**	**$10,988**	**$11,213**
Out of state/other	3,454	22,383	$149,024,104	$56,972,282	$73,641,211	1.33	6.5	$43,145	$16,495	$21,321
Total	**61,203**	**302,670**	**$1,738,873,036**	**$691,530,953**	**$721,161,456**	**0.97**	**4.9**	**$28,412**	**$11,299**	**$11,783**

Notes:
1. The initial dataset includes stays subsequently excluded as PPR global exclusions and non-events.
2. Estimated cost includes medical education.
3. MH/SA = mental health / substance abuse; ALOS = average length of stay.
4. Out of state/other mostly comprises out of stay hospitals plus a few stays labelled as Phoenix, Providence VAMC, SSTAR or St. Mary's Home.

2.4 Limitations of the Analysis

Readers should be aware of the limitations of the analysis.

- **Incomplete dataset.** The analytical dataset includes about 44% of Rhode Island inpatient admissions, including all Medicaid patients and almost all patients with commercial or Medicare managed care coverage. It excludes Medicare fee-for-service, out of state commercial payers such as Aetna or Cigna, the uninsured, and various other payers. Other payers had to be excluded because the state did not have the regulatory authority to collect the information needed to track patients from hospital to hospital after their index admission. By design, the study also excluded newborns, who represented about 6% of all stays. Nevertheless, the analysis, although limited to Rhode Island, is more comprehensive than almost all other readmission studies in terms of insurance status and medical conditions.
- **2010 time frame.** The study included index admissions in the January-November 2010 period and potentially preventable readmissions in the January-December period. Because this analysis is published in April 2014, it excludes the impact of any changes in the health care delivery system since 2010, including efforts to reduce readmissions. The 2010 dataset was used because the only comparable resource – the hospital discharge dataset compiled by the Department of Health – includes neither patient identifiers nor payment data. With the advent of the state's All Payer Claims Database, reports similar to this one can be produced on a more regular basis. Because of the interval since 2010, this report emphasizes findings that are likely to remain true today, although of course that cannot be said with certainty. We also compare Rhode Island results with those from other studies as a test of robustness.
- **PPR undercount.** The results shown in Chapter 3 likely represent a slight undercount of both PPR chains and PPR stays, for three reasons. First is that patients were uniquely identified only within each plan. A patient who switched insurance within 15 days of a discharge would be counted as two different individuals, and any PPRs would be missed. Similarly, any anomalies that resulted in the same patient having two different identifiers within a single plan would mean that a PPR might not be counted. Third, if a patient had a PPR chain that started in 2010 but continued into 2011, the count of PPR chains would be correct but the count of PPR stays would be low.
- **PPR algorithm.** We have applied the 3M PPR algorithm "as is," without any changes or a detailed evaluation of its clinical logic. We chose the PPR approach based on the experience of other states and on the algorithm's benefits in terms of transparency and generating actionable results.

3 Statewide PPR Patterns

In Chapter 3, we describe statewide patterns of potentially preventable readmissions as 11 findings, with one finding per section. Each finding reflects Rhode Island data specifically. Each finding is also substantial enough that it is unlikely to be sensitive to the time period (CY 2010) or to nuances in our data or methodology. Where appropriate, we compare our findings with evidence from other studies, especially the all-payer PPR analysis done in Florida, the New York Medicaid PPR analysis, the AHRQ all-payer analysis, and the Medicare analysis of readmissions for heart failure, heart attack, and pneumonia.

3.1 6.3% of Hospitalizations Were Followed by at Least One PPR

Overall, 6.3% of patients had at least one potentially preventable readmission (Table 3.1.1).[27] That is, 3,238 out of 51,739 index admissions were followed by at least one potentially preventable readmission. When a PPR occurred, other PPRs often followed. The total number of PPRs was 4,076, or an average of 1.26 PPRs per PPR chain.

PPR experience varied considerably by care category (and, as we shall see in Section 3.7, more specifically by DRG). In particular, patients with mental health or substance abuse (MH/SA) conditions were readmitted most often. One in eight adult MH/SA patients was back in hospital within 15 days for a potentially preventable reason. Once readmitted, these patients also had the highest rate of subsequent potentially preventable readmissions, with an average 1.59 PPRs per PPR chain.

Obstetric patients had the lowest PPR rates, at just 1.1%. This was expected, because of low rates of post-partum complications serious enough to warrant readmission. Oncology patients also had a relatively low PPR rate, at 3.9%. Although oncology patients are often readmitted, many of these readmissions are planned. Because this study focuses on potentially preventable readmissions, our reported rates are much lower than all-cause oncology rates reported elsewhere, for example by AHRQ.[28]

Table 3.1.1
PPR Rates Overall and by Care Category

Care Category	Index Admits	PPR Chains	PPR Rate	Total Readmissions			PPRs per PPR Chain	PPRs per 100 Admits
				Same Hospital	Other Hospital	All		
Pediatric								
Medical/surgical	3,418	154	4.5%	145	36	181	1.18	5.3
MH/SA	1,245	117	9.4%	58	88	146	1.25	11.7
Subtotal	**4,663**	**271**	**5.8%**	**203**	**124**	**327**	**1.21**	**7.0**
Adult								
Cardiac	6,627	490	7.4%	431	155	586	1.20	8.8
Orthopedics	4,959	205	4.1%	184	53	237	1.16	4.8
Oncology	1,427	55	3.9%	47	21	68	1.24	4.8
MH/SA	3,546	447	12.6%	328	383	711	1.59	20.1
Other medical	16,811	1,338	8.0%	1,155	507	1,662	1.24	9.9
Other surgical	5,246	341	6.5%	320	71	391	1.15	7.5
Subtotal	**38,616**	**2,876**	**7.4%**	**2,465**	**1,190**	**3,655**	**1.27**	**9.5**
Obstetrics	8,460	91	1.1%	81	13	94	1.03	1.1
Total	**51,739**	**3,238**	**6.3%**	**2,749**	**1,327**	**4,076**	**1.26**	**7.9**

Notes:

1. MH/SA = mental health and substance abuse.

2. 51,739 index stays + 4,076 readmissions = 55,815 stays in the analytical dataset.

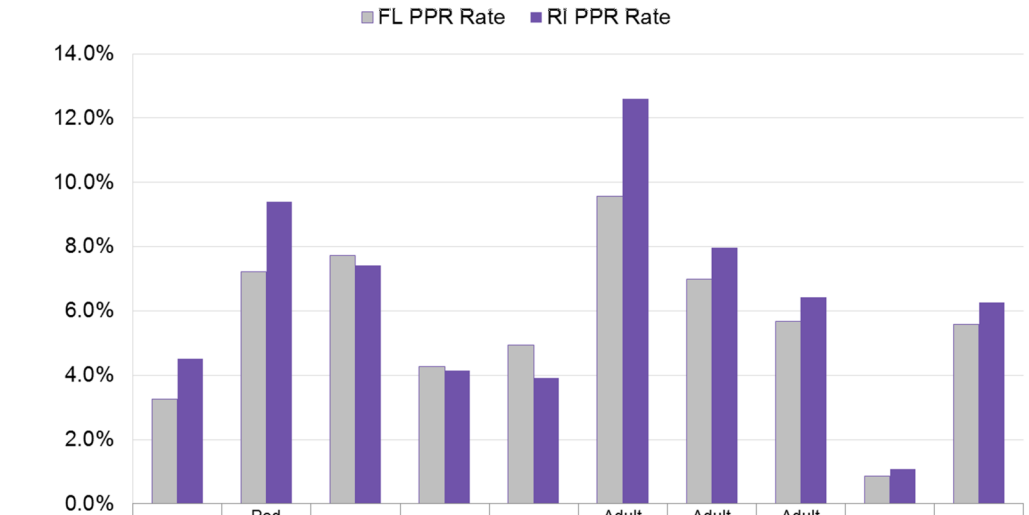
3.2 Results Were Similar to Those from Other States

As a general statement, PPR rates tend to be similar state to state but vary considerably by care category and by hospital.

Chart 3.2.1 compares our Rhode Island results with the very large all-payer dataset used by Florida. Florida results are available at the level of the DRG and the age group, enabling a comparison with Rhode Island that takes into account the different age profiles and DRG mixes of the two populations. Among other states, New York Medicaid reported results by Major Diagnostic Category, a detailed categorization scheme that can be compared with our care categories. Common themes across the states:

- Approximately 6% of stays were followed by a potentially preventable readmission within a 15-day period.
- PPR rates for MH/SA conditions were highest among the care categories. Moreover, the number of PPRs per PPR chain was also highest for MH/SA conditions.
- PPR rates for obstetrics were the lowest among the care categories.

Chart 3.2.1
Florida vs Rhode Island PPR Rates by Care Category



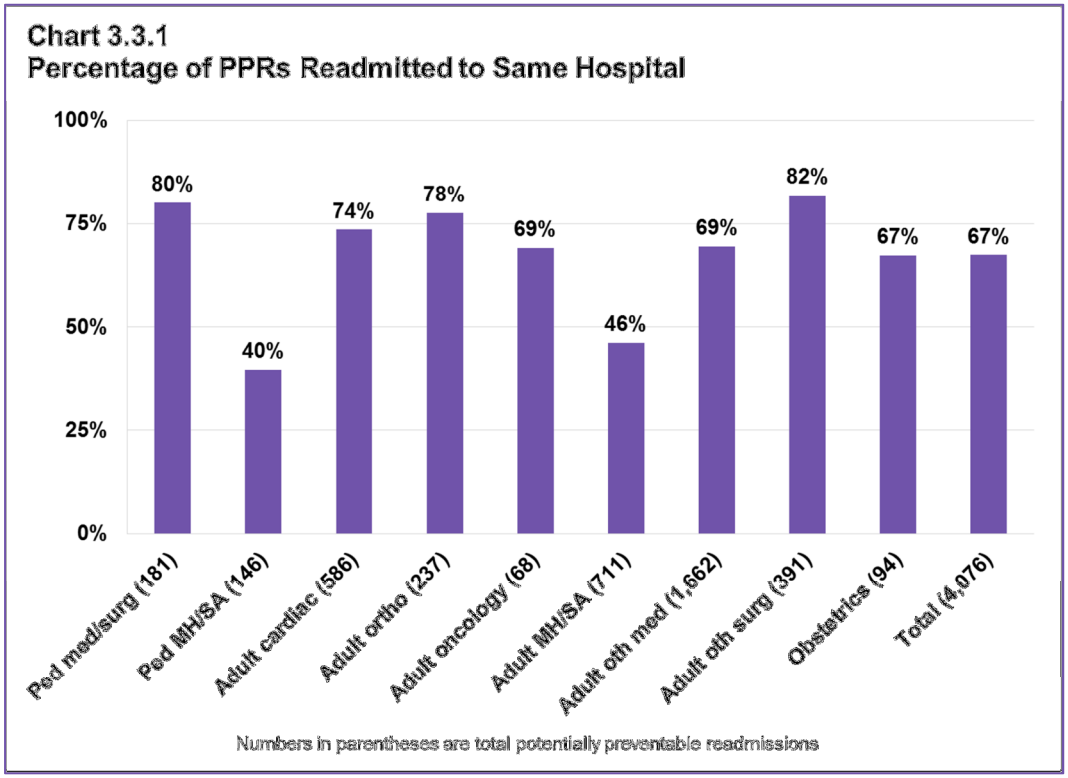
	Pediatric med/surg	Ped mental health	Adult cardiac	Adult ortho	Adult oncology	Adult mental health	Adult other medical	Adult other surgical	Obstetrics	Total
FL PPR Rate	3.3%	7.2%	7.7%	4.3%	4.9%	9.6%	7.0%	5.7%	0.9%	5.6%
RI PPR Rate	4.5%	9.4%	7.4%	4.1%	3.9%	12.6%	8.0%	6.4%	1.1%	6.3%

Florida results have been made comparable to Rhode Island results through adjustment for frequency by APR-DRG and age group.

3.3 About Two-Thirds of Readmissions Were to the Same Hospital

An advantage of using a payer dataset, rather than a hospital-specific dataset, is that it allows an overview of all readmissions for individual patients. Previous studies have concluded that the same-hospital readmission rate is an unreliable and biased indicator of the all-hospital readmission rate.[29] Chart 3.3.1 shows that about two-thirds of PPRs were to the same hospital on an overall basis, but with considerable variation by care category. Patients admitted for MH/SA conditions were particularly less likely to be readmitted to the same hospital. (This pattern was also seen in Florida.) Being readmitted to a different hospital presents obvious challenges for continuity of care.

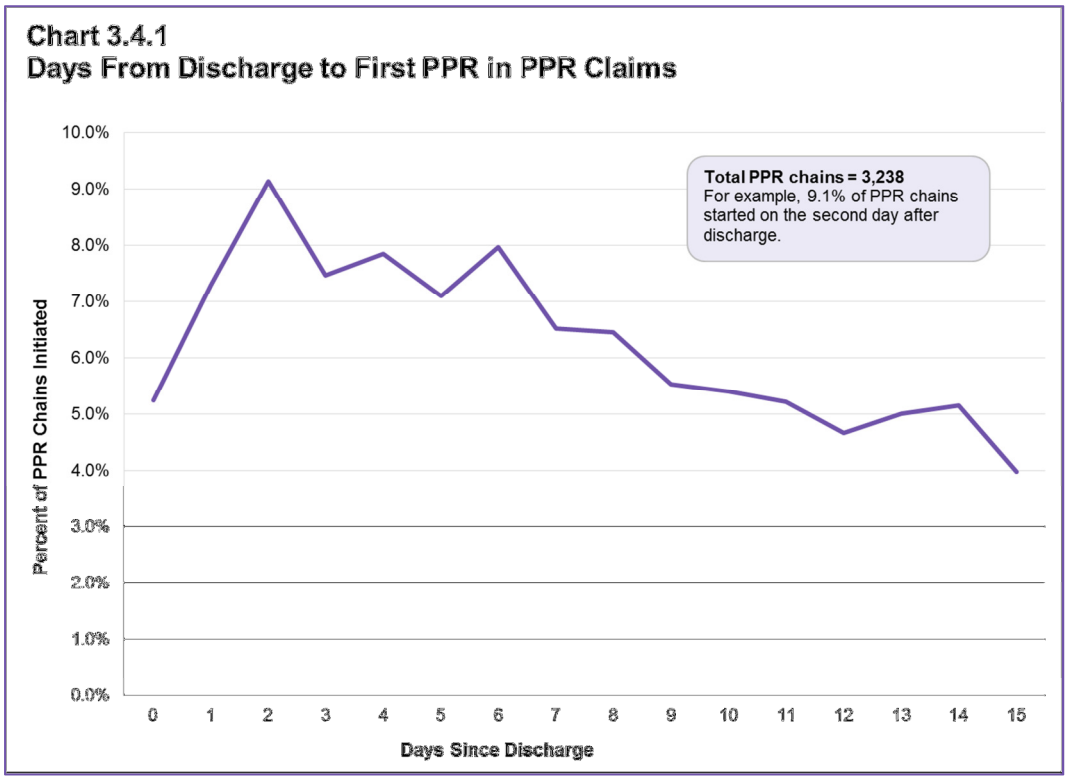
Surgical patients were most likely to be readmitted to the same hospital (e.g., the adult orthopedic and adult other surgical care categories). This makes sense; patients undergoing surgery who develop post-surgical complications such as infection or ileus would seem to be more likely to return to the same hospital for care.



3.4 The Risk of a PPR Peaked Two Days after Discharge

Chart 3.4.1 shows that the risk of a potentially preventable readmission peaked two days after discharge. This finding echoes the New York Medicaid PPR study [30] and a study of Medicare heart failure, heart attack, and pneumonia patients.[31]

The clinical implication is that efforts to reduce readmissions may be most effectively focused on the two days immediately following discharge. Two controlled trials that reported reductions in readmission rates focused their efforts on the period immediately following discharge, for example.[32] Chart 3.4.1 shows that the risk of a PPR falls steadily after the second day.



3.5 PPRs Represented About 7% of Payments

Potentially preventable readmissions represented 7% of all stays, 10% of hospital days, 7% of hospital charges, and 7% of payments. That is, total payment for 55,815 stays in the analytical dataset was $632 million, of which $47 million was for PPRs. Since these results are for 11 months of index admissions, an annualized estimate is $52 million (Table 3.5.1). For MH/SA conditions, PPRs represented 15% of stays and 17% of days, charges, and payments.

Although not all readmissions are preventable, a 10% reduction in PPRs would generate a saving of $5.2 million in payments to hospitals, plus associated savings in payments to physicians and other health care providers – not to mention the benefits to the patients. Moreover, any successful initiatives to reduce PPRs likely would have spillover benefits to Medicare fee-for-service beneficiaries and other patients who were outside the scope of this analysis. The total savings from a 10% reduction in potentially preventable readmissions likely would be considerably higher than $5.2 million. Efforts that reduced PPRs by more than 10% would generate larger savings.

Table 3.5.1
Hospital Charges and Medicaid Payments for PPRs

	Totals for All Stays				Totals for PPR Stays				PPRs as Percent of All			
Care Category	Stays	Days	Hospital Charges (Millions)	Payments (Millions)	Stays	Days	Hospital Charges (Millions)	Payments (Millions)	Stays	Days	Hospital Charges (Millions)	Payments (Millions)
Pediatric												
Medical/surgical	3,583	11,552	$87	$41	181	1,193	$7	$4	5%	10%	8%	9%
MH/SA	1,405	15,277	$33	$21	146	2,172	$5	$3	10%	14%	14%	15%
Subtotal	**4,988**	**26,829**	**$120**	**$62**	**327**	**3,365**	**$12**	**$7**	**7%**	**13%**	**10%**	**11%**
Adult												
Cardiac	7,136	31,237	$288	$101	586	3,414	$17	$6	8%	11%	6%	6%
Orthopedics	5,047	21,251	$176	$80	237	1,492	$7	$3	5%	7%	4%	3%
Oncology	1,446	5,235	$39	$17	68	380	$2	$1	5%	7%	5%	5%
MH/SA	4,342	30,929	$80	$37	711	5,555	$15	$7	16%	18%	18%	18%
Other medical	18,951	91,822	$442	$176	1,662	10,102	$46	$18	9%	11%	10%	10%
Other surgical	5,355	31,711	$243	$104	391	2,548	$13	$5	7%	8%	5%	5%
Subtotal	**42,277**	**212,185**	**$1,269**	**$516**	**3,655**	**23,491**	**$99**	**$40**	**9%**	**11%**	**8%**	**8%**
Obstetrics	8,550	25,915	$134	$54	94	249	$1	$1	1%	1%	1%	1%
Total	**55,815**	**264,929**	**$1,524**	**$632**	**4,076**	**27,105**	**$113**	**$47**	**7%**	**10%**	**7%**	**7%**

Note:
1. Figures on stays, days, charges and payments reflect 11 months of CY 2010 because index admissions in December 2010 were excluded from the report in order to allow a one-month run-out period for PPRs. Extrapolating the above results to the full 12-month period yields the following estimates.

Annualized Estimated PPR Totals			
Stays	Days	Hospital Charges (Millions)	Payments (Millions)
4,447	**29,569**	**$123**	**$52**

3.6 Recurrence or Continuation of the Original Condition Were Important Reasons for PPRs

A common misconception is that readmissions reflect frank medical error, such as leaving a sponge in a patient. Though such errors occur, Table 3.6.1 shows that they represent only a small part of the picture. Surgical complications, for example, accounted for just 2% of potentially preventable readmissions and some of those presumably could not have been avoided even with the best care. Of 4,076 PPRs, 20% were for recurrence of a medical problem and 24% were recurrence of a MH/SA condition. Another 34% of PPRs involved a medical admission followed by a PPR for another acute condition. The most common example was an index admission for heart failure (APR-DRG 194) followed by a potentially preventable readmission for septicemia and disseminated infections (APR-DRG 720). Our finding echoes that of a study of Medicare patients that found, for example, that for heart failure the most common readmission reasons were heart failure, renal disorders, pneumonia, arrhythmias, and septicemia/shock.[33]

Table 3.6.1
Potentially Preventable Readmissions, Percentage Split by Clinical Reason

Care Category	Potentially Preventable Readmissions	1 Medical—Recurrence or Continuation	2A Medical—Ambulatory Care Sensitive	2B Medical—Other Chronic Condition	3 Medical—Other Acute Condition	4 Surgical—Reoccurrence or Continuation	5 Surgical—Complication	6A MH—Index Admission not MH/SA	6B SA—Index Admission not MH/SA	6C MH/SA Readmission after Index MH/SA Admission
Pediatric										
Medical/surgical	181	41%	2%	9%	34%	2%	3%	9%	0%	1%
MH/SA	146	0%	1%	1%	0%	0%	0%	0%	0%	98%
Subtotal	**327**	**23%**	**2%**	**5%**	**19%**	**1%**	**2%**	**5%**	**0%**	**44%**
Adult										
Cardiac	586	35%	6%	10%	40%	3%	2%	4%	1%	0%
Orthopedics	237	11%	7%	8%	51%	7%	7%	8%	1%	0%
Oncology	68	22%	3%	1%	51%	10%	7%	1%	3%	0%
MH/SA	711	0%	1%	2%	3%	0%	0%	0%	0%	94%
Other medical	1,662	29%	8%	9%	35%	0%	1%	7%	2%	10%
Other surgical	391	4%	4%	7%	66%	7%	9%	2%	1%	0%
Subtotal	**3,655**	**20%**	**6%**	**8%**	**34%**	**2%**	**2%**	**4%**	**1%**	**23%**
Obstetrics	94	6%	0%	0%	94%	0%	0%	0%	0%	0%
Total	**4,076**	**20%**	**5%**	**7%**	**34%**	**2%**	**2%**	**4%**	**1%**	**24%**

Notes:

1. Percentages refer to total PPRs for each row. For example, 20% of the total 4,076 stays were for medical recurrence or continuation.
2. MH/SA = mental health / substance abuse.

3.7 PPR Rates Varied Widely by Reason for Admission

To understand the incidence and risk of potentially preventable readmissions, we look at the PPR rates by All Patient Refined Diagnosis Related Group (APR-DRG). An APR-DRG has the format 123-1, where the first three digits may be thought of as the reason for admission and the fourth digit as the severity of illness. In this section, we consider three views of PPR rates by reason for admission.

Table 3.7.1 shows PPR rates sorted in declining order of total PPR stays. This view is most useful in understanding what types of patients account for most PPRs. A high total number of PPRs may reflect high incidence of the index admission, a high PPR rate, and/or a high number of PPRs per PPR chain. For bipolar disorders and major depressive disorders, all three factors come into play.

Table 3.7.1
PPR Rates by APR-DRG: Top 20 APR-DRGs in Terms of Total Potentially Preventable Readmissions

Base DRG	Index Admits	PPR Chains	PPR Rate	PPR Stays	PPR Stays per Chain	PPRs / 100 Stays
753 - Bipolar disorders	1,653	193	11.7%	295	1.5	17.8
751 - Major depressive disorders & other/unspecified psychoses	1,257	157	12.5%	226	1.4	18.0
194 - Heart failure	1,214	139	11.4%	176	1.3	14.5
140 - Chronic obstructive pulmonary disease	1,312	114	8.7%	148	1.3	11.3
750 - Schizophrenia	433	79	18.2%	138	1.7	31.9
139 - Other pneumonia	1,306	106	8.1%	123	1.2	9.4
775 - Alcohol abuse & dependence	667	79	11.8%	115	1.5	17.2
754 - Depression except major depressive disorder	782	70	9.0%	113	1.6	14.5
720 - Septicemia & disseminated infections	668	66	9.9%	79	1.2	11.8
201 - Cardiac arrhythmia & conduction disorders	928	65	7.0%	78	1.2	8.4
221 - Major small & large bowel procedures	594	61	10.3%	76	1.2	12.8
463 - Kidney & urinary tract infections	969	62	6.4%	73	1.2	7.5
383 - Cellulitis & other bacterial skin infections	966	63	6.5%	71	1.1	7.3
048 - Peripheral, cranial & autonomic nerve disorders	119	17	14.3%	62	3.6	52.1
460 - Renal failure	531	49	9.2%	59	1.2	11.1
812 - Poisoning of medicinal agents	318	50	15.7%	55	1.1	17.3
773 - Opioid abuse & dependence	381	37	9.7%	53	1.4	13.9
254 - Other digestive system diagnoses	392	39	9.9%	51	1.3	13.0
560 - Vaginal delivery	4,998	49	1.0%	50	1.0	1.0
190 - Acute myocardial infarction	309	36	11.7%	43	1.2	13.9
Top 20	**19,797**	**1,531**	**7.7%**	**2,084**	**1.4**	**10.5**
All DRGs	**51,739**	**3,238**	**6.3%**	**4,076**	**1.3**	**7.9**
Top 20 as percent of all	**38%**	**47%**		**51%**		

Note:
1. The APR-DRG shown is the DRG for the index admission.

Table 3.7.2 provides similar information, except ranked in declining order of index admissions. Deliveries rank highest in terms of index admissions, but they have very few potentially preventable readmissions. Bipolar disorder and major depression again rank near the top of the list, reflecting the prevalence of these conditions.

Table 3.7.2
PPR Rates by APR-DRG: Top 20 APR-DRGs in Terms of Total Index Admissions

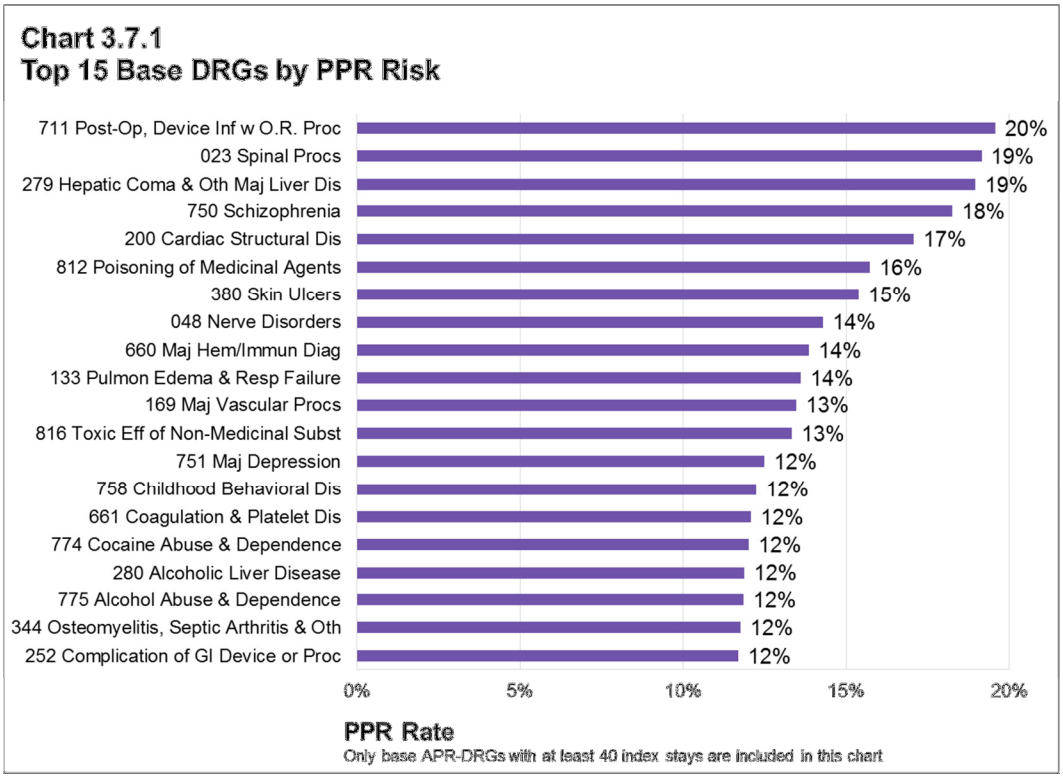
Base DRG	Index Admits	PPR Chains	PPR Rate	PPR Stays	PPR Stays per Chain	PPRs / 100 Stays
560 - Vaginal delivery	4,998	49	1.0%	50	1.0	1.0
540 - Cesarean delivery	2,454	32	1.3%	33	1.0	1.3
753 - Bipolar disorders	1,653	193	11.7%	295	1.5	17.8
140 - Chronic obstructive pulmonary disease	1,312	114	8.7%	148	1.3	11.3
139 - Other pneumonia	1,306	106	8.1%	123	1.2	9.4
751 - Major depressive disorders & other/unspecified psychoses	1,257	157	12.5%	226	1.4	18.0
194 - Heart failure	1,214	139	11.4%	176	1.3	14.5
463 - Kidney & urinary tract infections	969	62	6.4%	73	1.2	7.5
383 - Cellulitis & other bacterial skin infections	966	63	6.5%	71	1.1	7.3
201 - Cardiac arrhythmia & conduction disorders	928	65	7.0%	78	1.2	8.4
302 - Knee joint replacement	884	21	2.4%	22	1.0	2.5
754 - Depression except major depressive disorder	782	70	9.0%	113	1.6	14.5
301 - Hip joint replacement	695	24	3.5%	25	1.0	3.6
720 - Septicemia & disseminated infections	668	66	9.9%	79	1.2	11.8
775 - Alcohol abuse & dependence	667	79	11.8%	115	1.5	17.2
249 - Non-bacterial gastroenteritis, nausea & vomiting	598	26	4.3%	27	1.0	4.5
221 - Major small & large bowel procedures	594	61	10.3%	76	1.2	12.8
141 - Asthma	562	18	3.2%	20	1.1	3.6
513 - Uterine & adnexa proc for non-malignancy except leiomyoma	562	14	2.5%	14	1.0	2.5
460 - Renal failure	531	49	9.2%	59	1.2	11.1
Top 20	**23,069**	**1,359**	**5.9%**	**1,764**	**1.3**	**7.6**
All DRGs	**51,739**	**3,238**	**6.3%**	**4,076**	**1.3**	**7.9**
Top 20 as percent of all	**45%**	**42%**		**43%**		

Note:
1. The APR-DRG shown is the DRG for the index admission.

Chart 3.7.1 shows which patients were at highest risk for a PPR (excluding low-volume DRGs). For example, 20% of patients in DRG 711 (Post-Operative, Post Trauma or Other Device Infections with O.R. Procedure) had a PPR within 15 days, as did 19% of patients in DRG 023, Spinal Procedures.

This chart can be used by hospitals to target their efforts at those patients at highest risk of a PPR. For example, within an orthopedic service the patients with spinal procedures were at much higher risk of a PPR than the patients in DRG 302, Knee Joint Replacement, for which the PPR rate was just 2.4% (from Table 3.7.2). This Rhode Island finding echoes a similar finding from the much larger Florida dataset.

Supplementary Table S.2.1 (available in a companion document at www.ohic.ri.gov) shows results for every DRG.



3.8 Severity of Illness Affected the Risk of Readmission

While the previous finding concerned the reason for admission, this finding focuses on the severity of illness for any given base DRG. Within the APR-DRG system, severity of illness is ranked from 1 to 4, reflecting minor, moderate, major, or extreme severity. Table 3.8.1 shows the PPR rates by severity for the top 10 base DRGs in terms of total PPRs.

We see a clear tendency for PPR rates to rise as severity of illness rises. For example, for nine of the 10 DRGs, the PPR rate for Severity 2 stays was higher than for Severity 1 stays. For eight of the 10 DRGs, the PPR rate for Severity 3 stays was higher than for Severity 2 stays. The finding is clinically intuitive and consistent with results from other PPR studies. The implication is that any comparison of PPR rates needs to take into account not only the reason for admission (that is, the base DRG) but also the severity of illness.

Table 3.8.1
Index Admissions and PPR Rates by Level of Severity for the Top 10 Base DRGs in Terms of Total Readmissions

Base DRG of the Index Admission		All Severities	Level of Severity			
			Severity 1	Severity 2	Severity 3	Severity 4
753 - Bipolar disorders	Index Admits	1,653	1,073	547	30	3
	PPR Rate	11.7%	10.6%	13.9%	6.7%	33.3%
751 - Major depressive disorders & other/unspecified psychoses	Index Admits	1,257	642	581	27	7
	PPR Rate	12.5%	11.5%	12.9%	22.2%	28.6%
194 - Heart failure	Index Admits	1,214	147	632	392	43
	PPR Rate	11.4%	8.8%	10.8%	13.8%	9.3%
140 - Chronic obstructive pulmonary disease	Index Admits	1,312	316	678	288	30
	PPR Rate	8.7%	6.6%	8.6%	10.8%	13.3%
750 - Schizophrenia	Index Admits	433	187	229	15	2
	PPR Rate	18.2%	19.8%	17.5%	13.3%	0.0%
139 - Other pneumonia	Index Admits	1,306	245	679	318	64
	PPR Rate	8.1%	4.5%	7.4%	12.3%	9.4%
775 - Alcohol abuse & dependence	Index Admits	667	374	262	25	6
	PPR Rate	11.8%	10.7%	13.0%	20.0%	0.0%
754 - Depression except major depressive disorder	Index Admits	782	542	233	7	0
	PPR Rate	9.0%	7.0%	13.3%	14.3%	0.0%
720 - Septicemia & disseminated infections	Index Admits	668	37	166	273	192
	PPR Rate	9.9%	0.0%	6.0%	11.0%	13.5%
201 - Cardiac arrhythmia & conduction disorders	Index Admits	928	290	476	144	18
	PPR Rate	7.0%	3.4%	8.0%	8.3%	27.8%

3.9 Patient Age and the Presence of a MH/SA Comorbidity Affected PPR Risk

Previous PPR studies have found two additional factors that affect the risk of a potential preventable readmission, even after taking into account reason for admission and severity of illness.[34]

- **Major mental health or substance abuse comorbidity.** Although schizophrenia, bipolar disorder, and other major mental health or substance abuse disorders often increase the severity of illness assignment for medical and surgical conditions under APR-DRGs, previous research in Florida, New York and elsewhere has found separate effects on PPR risk when a MH/SA comorbidity is present.[35] In Rhode Island, we found that the risk roughly doubled, even after taking into account casemix as measured by APR-DRG and age group (Table 3.9.1).
- **Age.** Even for the same APR-DRG, patient age appears to have a separate and noticeable impact on PPR risk. In other states, patients under age 18 tended to have lower PPR rates than adults, while older patients (especially 85 and over) tended to have higher rates than the 18-84 population. Note that these effects reflect more than the absence or presence of comorbidities, since the APR-DRG algorithm already takes into account all secondary diagnoses coded by the hospital. (Hospitals are supposed to report all diagnoses that have any bearing on the stay.[36]) Within the Rhode Island dataset, there were only a few DRGs that met our volume standards for both the pediatric and adult populations. The Rhode Island evidence therefore was equivocal. Based on clear tendencies in data from Florida and elsewhere, however, it would be reasonable to expect a similar pattern if there were more data in the Rhode Island dataset.

Table 3.9.1
Adjustment for MH/SA Comorbidity

Age Category	MH/SA Comorbidity	Index Admits	Actual PPR Chains	Actual PPR Rate	Expected PPR Chains	Expected PPR Rate	A/E	Risk Ratio
Pediatric	Yes	325	49	15.08%	30	9.1%	1.66	
Pediatric	No	4,574	228	4.98%	247	5.4%	0.92	1.80
All pediatric		4,899	277	5.65%	277	5.7%	1.00	
Adult	Yes	4,523	660	14.59%	361	8.0%	1.83	
Adult	No	42,317	2,301	5.44%	2,600	6.1%	0.88	2.07
All adult		46,840	2,961	6.32%	2,961	6.3%	1.00	
All		**51,739**	**3,238**	**6.26%**	**3,238**	**6.3%**	**1.00**	

Notes:

1. MH/SA = mental health and substance abuse.
2. For pediatric patients, for example, the overall PPR rate was 5.7%. Using the Rhode Island statewide pediatric PPR rates by APR-DRG as norms, the expected number of PPRs with a MH/SA comorbidity was 30. The actual number was 49, for an actual/expected ratio of 1.66. The similarly calculated A/E ratio for pediatric patients without a MH/SA comorbidity was 0.92. We infer that the presence of a MH/SA comorbidity almost doubled the risk of a PPR, that is, 1.66/0.92 = 1.80, even after taking into account the reason for admission, severity of illness, and age group.
3. This table includes all stays within the analytical dataset, with obstetric patients in the pediatric or adult sub-populations as appropriate. Other PPR studies vary in whether obstetric and MH/SA stays are included. Regardless of the methodology used, previous studies have all found substantial risk ratios.

3.10 PPR Rates Tended to Be Higher for Medicaid Patients

PPR rates can be compared across populations, for example by insurance status. Any such comparison must be adjusted for differences in casemix, however. In Table 3.10.1, for example, comparing the actual PPR rates of 7.8% for Medicare managed care and 5.7% for Medicaid managed care takes no account of the fact that Medicare managed care beneficiaries are older and sicker than Medicaid managed care beneficiaries. (Table 2.3.2 shows that average casemix was 1.21 in the Medicare managed care population and 0.67 in the Medicaid managed care population.) To create a valid comparison, the typical approach is to calculate for each sub-population the PPR rate that would be expected for patients with the same risk characteristics, e.g., reason for admission, severity of illness, age group, and presence or absence of a MH/SA comorbidity. The ratio of the actual PPR rate to the expected PPR rate (A/E ratio) then provides the casemix-adjusted comparison. For this analysis, we calculated “expected” PPR rates using norms by APR-DRG, age group, and MH/SA comorbidity from the very large Florida all-payer population. (See Appendix Section A.2 for details on the norms.)

Table 3.10.1
Actual vs Expected PPR Rates by Payer

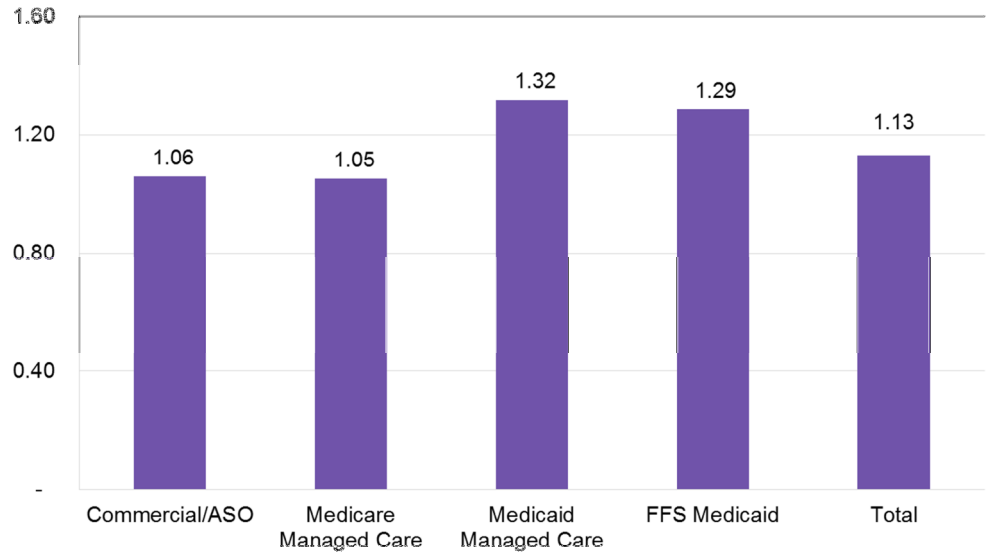
Care Category	Index Admits	PPR Chains		PPR Rate		Actual / Expected
		Actual	Expected	Actual	Expected	
All Care Categories						
Commercial	18,482	838	793	4.5%	4.3%	1.06
Medicare Managed Care	15,879	1,237	1,178	7.8%	7.4%	1.05
Medicaid Managed Care	13,654	781	594	5.7%	4.3%	1.32
FFS Medicaid	3,724	382	297	10.3%	8.0%	1.29
Total	**51,739**	**3,238**	**2,861**	**6.3%**	**5.5%**	**1.13**
MH/SA Care Category						
Commercial	1,514	154	126	10.2%	8.3%	1.22
Medicare Managed Care	235	18	22	7.7%	9.3%	0.82
Medicaid Managed Care	2,423	293	208	12.1%	8.6%	1.41
FFS Medicaid	619	99	69	16.0%	11.1%	1.44
Total	**4,791**	**564**	**425**	**11.8%**	**8.9%**	**1.33**

Notes:

1. "Expected" PPR chains and rates reflect Florida all-payer norms. Overall, RI PPR rates were higher than comparable Florida norms by factors of 1.13 for all care categories and 1.33 for MH/SA. For purposes of this table, the more relevant comparison is of A/E ratios by payer. That is, after casemix adjustment, the two Medicaid payer categories had notably higher PPR rates than the commercial and Medicare managed care categories. For additional methodological detail, see Appendix Section A.2.
2. FFS = fee for service; MH/SA = mental health and substance abuse.

As shown in Table 3.10.1 and Chart 3.10.1, the A/E rates were more in line with intuition. After adjustment for differences in casemix, the two Medicaid populations had similar A/E ratios that were about 23% higher than the A/E ratios for the commercial and Medicare managed care populations.[37] The 23% differential is very similar to that found in Florida.[38] For MH/SA readmissions specifically, Medicaid rates also were notably higher than for the commercial and Medicare managed care populations. In general, Medicaid insurance status is often associated with higher risk of readmission.[39] Rhode Island is no different.

Chart 3.10.1
Actual-to-Expected PPR Ratios by Insurance Status



A/E ratios enable casemix-adjusted comparisons of PPR rates by comparing the actual PPR for a sub-population with the PPR rate that would be expected for a sub-population of the same casemix (as measured by APR-DRG, age, and MH/SA comorbidity).

3.11 PPRs Represented about 60% of All Readmissions

As discussed in Section 2.1, there are many ways to measure readmissions. Throughout this report, we have measured potentially preventable readmission to any hospital using a 15-day post-discharge window.

A common question concerns the difference between all-cause readmission rates and potentially preventable readmission rates. Medicare and AHRQ, for example, use all-cause rates. The PPR software is capable of calculating all-cause readmission rates as well as PPR rates. Starting from the same initial dataset of 61,203 stays, Table 3.11.1 shows that all-cause readmission rates were noticeably higher than PPR rates. That is, only about 50% to 60% of total readmissions were considered potentially preventable. Amy E. Boutwell and Stephen F. Jencks, who used three methods to measure readmissions in the same Massachusetts dataset, similarly found that the all-cause methods identified substantially more readmissions than the PPR software.[40]

There are two key differences between the PPR and all-cause approaches. First, the "global exclusion and non-event" logic in the PPR software means that readmissions are not counted if, for example, the patient had metastatic cancer.[41] Second, PPR criteria specific to each DRG identify which readmission DRGs do and do not count as "potentially preventable."

The table also shows that 15-day readmission rates tend to be about two-thirds of 30-day rates. That is, doubling the readmission window adds only about half as many new PPR chains. This is because the risk of a PPR readmission peaks shortly after discharge and declines steadily after that (Chart 3.4.1). This finding is consistent with previous research.

Table 3.11.1
Alternative Views of Readmission Rates

Stays	7 Day PPR	7 Day All Cause	15 Day PPR	15 Day All Cause	30 Day PPR	30 Day All Cause
Initial dataset	61,203	61,203	61,203	61,203	61,203	61,203
Minus PPR grouping errors	90	90	90	90	90	90
Minus non-events and global exclusions	5,351	-	5,298	-	5,255	-
Equals analytical dataset for readmission analysis	55,762	61,113	55,815	61,113	55,858	61,113
Index admissions	53,366	56,399	51,739	53,898	49,886	50,992
Readmission chains	2,056	3,970	3,238	5,528	4,341	6,924
Readmission rate (chains / index admissions)	3.9%	7.0%	6.3%	10.3%	8.7%	13.6%
Total readmissions	2,396	4,714	4,076	7,215	5,972	10,121
Readmissions per chain	1.2	1.2	1.3	1.3	1.4	1.5
Readmission chains as percentage of initial dataset	3.4%	6.5%	5.3%	9.0%	7.1%	11.3%

Note:

1. Analytical dataset for readmission analysis = index admissions + total readmissions. Readmission rate = readmission chains as a percentage of index admissions.

Appendix A Comparing PPR Rates

While Chapter 3 mainly looked at potentially preventable readmissions at the statewide level, this appendix shows a methodology for comparing PPR rates across sub-populations after taking into account differences in casemix. We use hospitals as an example, but the same methodology was applied to payers in Section 3.10 and also can be used to compare individual health plans, geographic areas, or any other split of the population into sub-populations.

A.1 Casemix Adjustment Is Essential for Fair Comparison

At this point, we hope we have demonstrated that comparisons of PPR rates are meaningless unless adjusted for differences in casemix. In 2010, the PPR rate at Butler Hospital was 10.4%, or seven times higher than the 1.5% rate at Women & Infants. But Butler serves psychiatric patients, who have high PPR rates nationwide, while Women & Infants serves many obstetric patients, who have low PPR rates nationwide. Any comparison of these two hospitals must take casemix into account.

Following precedent from earlier PPR studies, we define "casemix" in practice to encompass the reason for admission (base APR-DRG), severity of illness (by APR-DRG), patient age (0-17, 18-64, 65+) and the absence or presence of a major MH/SA comorbidity. We do not take into account the patient's gender, race, income, or similar factors, even though these factors have added explanatory power in some earlier studies.[42] Our decision echoes the policy of the National Quality Forum, which says "risk models should not obscure disparities in care for populations by including factors that are associated with differences/inequalities in care, such as race, socioeconomic status, or gender."[43] This question is currently being actively debated.[44] Various authors have argued that excluding socioeconomic factors penalizes hospitals or plans that serve large low-income populations. Insurance status also seems to affect the risk of a readmission; in Section 3.10, for example, we saw that Medicaid patients in Rhode Island were at higher risk of a PPR than commercially insured or Medicare managed care patients.

A.2 Casemix Adjustment

The typical approach for performing casemix-adjusted comparisons is to compare the actual PPR rate to the expected PPR rate, where the expected PPR rate reflects the casemix of the population being analyzed. Suppose, for example, that the statewide PPR rates for cesarean section (APR-DRG 540) are 0.7% for severity 1 and 3.5% for severity 3. These figures then become the norms used in calculating expected PPR rates. A hospital whose stays were split 75%/25% between severity 1 and severity 3 would have an expected PPR rate of 1.4%, for example. If its actual PPR rate were 2.0%, then its actual-to-expected (A/E) ratio would be 2.0% / 1.4% = 1.43. We would infer that the hospital had more PPRs than would be expected for a hospital of its casemix. This example is simplified; in practice, casemix adjustment takes into account not only the APR-DRG but also the patient's age group and the presence or absence of a MH/SA comorbidity, as discussed in Section 3.9.

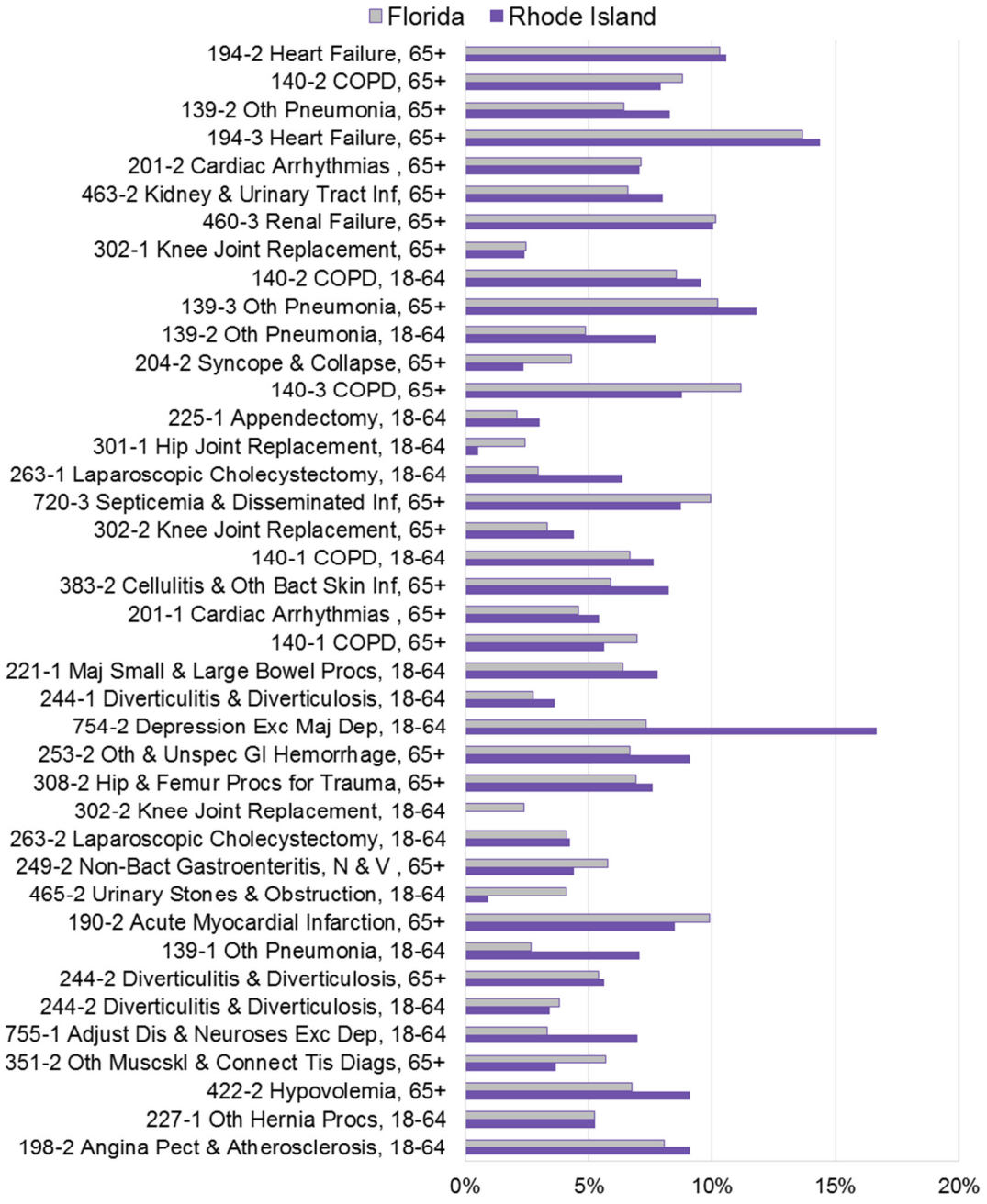
In Rhode Island, however, there are challenges in using the statewide PPR rates as norms. The small number of hospitals, exacerbated by specialization among hospitals, means that many DRGs are dominated by one or two hospitals. Four-fifths of pediatric medical and surgical stays are at Rhode Island Hospital's Hasbro unit, for example. Similarly, two-thirds of cesarean sections in our analytical dataset were at Women & Infants. If the Rhode Island statewide rates were used as norms, in many cases we essentially would be comparing a hospital against itself. Indeed, only 50 out of 3,238 risk cells (combination of APR-DRG and age group) both exceeded our low-volume threshold and were provided by enough hospitals that no hospital had more than a 25% share.

To address this issue, we used data from the very large Florida all-payer dataset to establish the norms used in calculating expected PPR rates. Although the two states are obviously different, we adjust for many of the most important differences by performing the comparison at the level of the APR-DRG and age group, adjusted where applicable by the presence of MH/SA comorbidity. For example, we compare a hospital's actual PPR rate for patients assigned to APR-DRG 194-1 (heart failure, severity 1) in the 65+ age group without a MH/SA comorbidity to the Florida PPR rate for patients assigned to APR-DRG 194-1 in the 65+ age group without a MH/SA comorbidity.

We performed two comparisons of how well the Florida data fit the Rhode Island data.

- At the level of the care category, we saw in Chart 3.2.1 that that Florida PPR rates were similar to (but not the same as) Rhode Island rates.
- At the level of the risk cell, we compared Florida and Rhode Island for the 50 risk cells referenced above. (To exceed the low-volume threshold, a risk cell had to include at least 40 index admissions and at least five PPR chains.) These 50 cells represented 16% of all stays in the Rhode Island analytical dataset. The PPR RI statewide PPR rates for these risk cells were assumed to be reasonably stable and not overly dependent on any individual hospital's performance. For these 50 cells, the correlation coefficient between the Rhode Island and Florida PPR rates was 0.74, where 0.00 would indicate no relationship between the two sets of norms and 1.00 would indicate a perfect relationship. Chart A.2.1 shows the top 40 cells that met all three criteria. For APR-DRG 194-2 (heart failure, severity 2), age group 65+, the Rhode Island and Florida norms were almost identical. Similar consistency in other common risk cells was reassuring about the applicability of Florida norms to Rhode Island data. Other risk cells, however, showed quite different rates. An example is DRG 754-2 (depression, severity 2), age group 18-64, where the Rhode Island PPR rate was much higher than the Florida rate.

Chart A.2.1
Comparison of Florida Norms with Rhode Island Norms



This chart shows the 40 largest risk cells (combination of APR-DRG and age group) where the RI data met all three criteria: at least 40 index admissions, at least five PPR chains, and no hospital accounted for more than 25% of statewide volume. COPD=chronic obstructive pulmonary disease. N&V=nausea and vomiting

A.3 Actual and Expected PPR Rates by Care Category

Table A.3.1 shows results by care category of comparing actual Rhode Island PPR rates with expected PPR rates calculated from the Florida data. For the adult cardiac and adult orthopedic categories, for example, Rhode Island PPR rates were exactly as would be expected based on the Florida norms. That is, the actual to expected (A/E) ratio was 1.00. For all other categories (except the small oncology category), the Rhode Island PPR rates were higher than the Florida-based norms. As a result, the overall Rhode Island rate of 6.3% was 13% higher than the rate that would have been expected based on the Florida norms for a patient population with Rhode Island characteristics (i.e., APR-DRGs, age groups, and MH/SA comorbidities).

Table A.3.1
Actual vs Expected PPR Rates by Care Category

Care Category	Index Admits	PPR Chains		PPR Rate		Actual / Expected
		Actual	Expected	Actual	Expected	
Pediatric						
Medical/surgical	3,418	154	110	4.5%	3.2%	1.40
MH/SA	1,245	117	96	9.4%	7.7%	1.22
Subtotal	**4,663**	**271**	**205**	**5.8%**	**4.4%**	**1.32**
Adult						
Cardiac	6,627	490	491	7.4%	7.4%	1.00
Orthopedics	4,959	205	205	4.1%	4.1%	1.00
Oncology	1,427	55	71	3.9%	5.0%	0.77
MH/SA	3,546	447	330	12.6%	9.3%	1.36
Other medical	16,811	1,338	1,209	8.0%	7.2%	1.11
Other surgical	5,246	341	284	6.5%	5.4%	1.20
Subtotal	**38,616**	**2,876**	**2,590**	**7.4%**	**6.7%**	**1.11**
Obstetrics	8,460	91	66	1.1%	0.8%	1.38
Total	**51,739**	**3,238**	**2,861**	**6.3%**	**5.5%**	**1.13**

Note:
1. "Expected" PPR chains and rates reflect Florida all-payer norms.

A.4 Actual and Expected PPR Rates by Hospital

Table A.4.1 shows PPR rates by hospital. After casemix adjustment, hospitals with A/E ratios above 1.13 had more potentially preventable readmissions than the Rhode Island statewide average while hospitals with A/E ratios below 1.13 had fewer PPRs than the statewide average. Among the 13 Rhode Island hospitals, there was a 1.6-fold difference in A/E ratios, from 0.84 to 1.33. If anything, this range is tighter than seen in similar studies elsewhere.

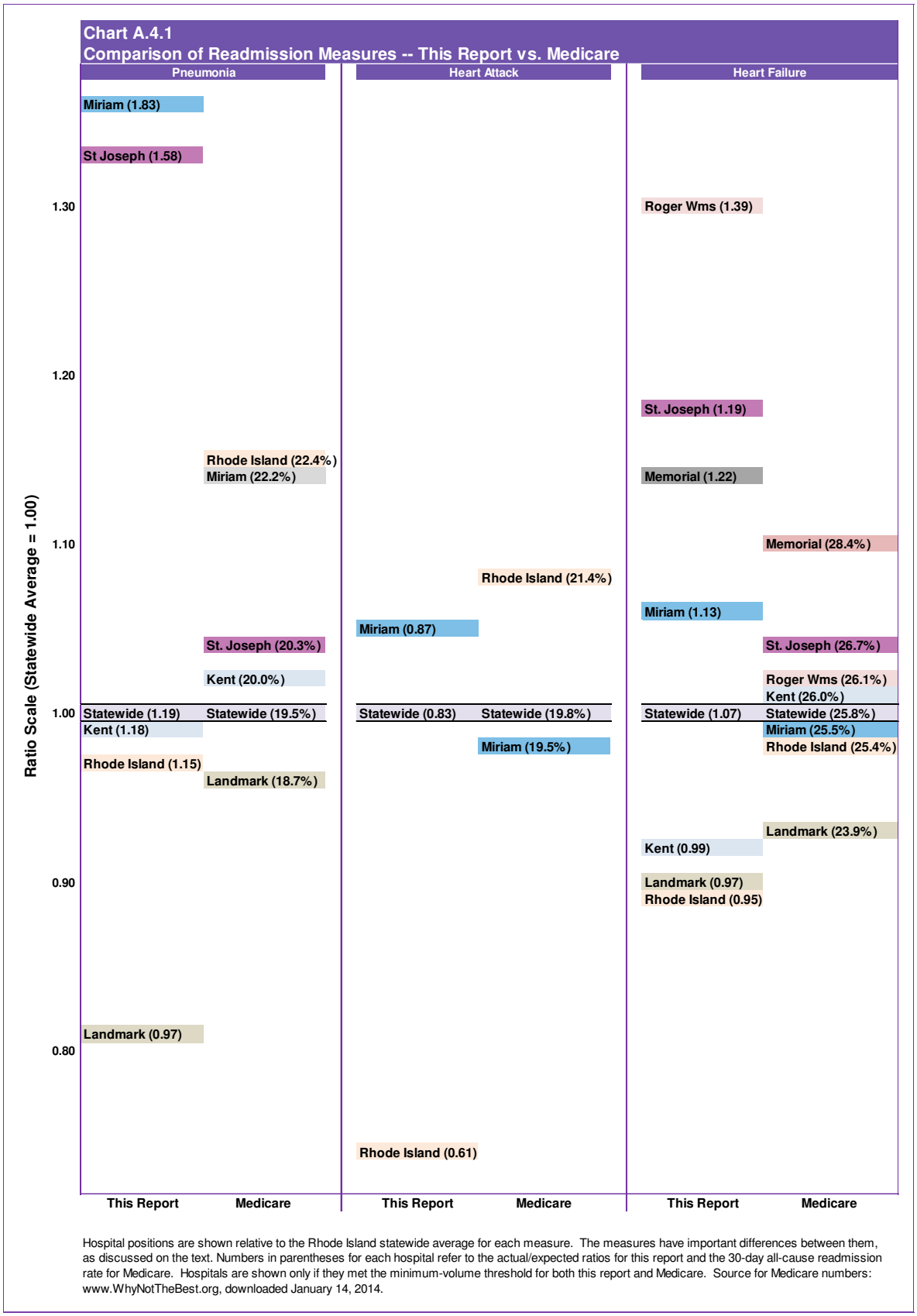
Importantly, Table A.4.1 reflects expected PPR rates based only on reason for admission, severity of illness, age group, and absence or presence of a MH/SA comorbidity. Some researchers argue that insurance status – i.e., Medicaid eligibility – should also be included as an explanatory factor. Following precedent from other studies, we have not done that. If we had, the results would have been different.

Chart A.4.1 compares hospital-specific PPR rates with Medicaid rates compiled by the Commonwealth Fund. For specific diagnoses that constitute Medicare's "heart failure" category in the 65+ age group, for example, both the PPR measure and the Medicare data show Roger Williams, St. Joseph, and Memorial with readmission rates above the statewide average. Similarly, both measures show Rhode Island Hospital and Landmark rates below the statewide average. For heart failure, the two measures resulted in similar rankings of hospitals (r_s = 0.82, where r_s = 1.00 would indicate identical rankings under both measures). For pneumonia, the rankings were weakly correlated (r_s = 0.40).

Table A.4.1
Actual vs Expected PPR Rates by Hospital

Care Category	Index Admits	PPR Chains		PPR Rate		Actual / Expected
		Actual	Expected	Actual	Expected	
Rhode Island	13,081	866	792	6.6%	6.1%	1.09
Women & Infants	7,258	107	80	1.5%	1.1%	1.33
Kent	5,888	403	364	6.8%	6.2%	1.11
Miriam	5,859	462	378	7.9%	6.4%	1.22
St. Joseph	2,957	260	215	8.8%	7.3%	1.21
Roger Williams	2,717	209	172	7.7%	6.3%	1.21
Landmark	2,531	178	178	7.0%	7.0%	1.00
Memorial	2,227	117	126	5.3%	5.7%	0.93
South County	1,867	77	93	4.1%	5.0%	0.83
Butler	1,840	192	146	10.4%	7.9%	1.31
Newport	1,422	68	78	4.8%	5.5%	0.87
Westerly	830	37	44	4.5%	5.3%	0.84
Bradley	517	46	40	8.9%	7.7%	1.16
Subtotal RI	**48,994**	**3,022**	**2,707**	**6.2%**	**5.5%**	**1.12**
Out-of-state/other	2,745	216	155	7.9%	5.6%	1.40
Total	**51,739**	**3,238**	**2,861**	**6.3%**	**5.5%**	**1.13**

Note:
1. "Expected" PPR chains and rates reflect Florida all-payer norms. See Appendix Section A.3.



Hospital positions are shown relative to the Rhode Island statewide average for each measure. The measures have important differences between them, as discussed on the text. Numbers in parentheses for each hospital refer to the actual/expected ratios for this report and the 30-day all-cause readmission rate for Medicare. Hospitals are shown only if they met the minimum-volume threshold for both this report and Medicare. Source for Medicare numbers: www.WhyNotTheBest.org, downloaded January 14, 2014.

Appendix B Analytical Dataset

According to the Rhode Island Department of Health hospital discharge dataset, there were 139,743 inpatient stays in Rhode Island hospitals in CY 2010. Table B.1 shows a reconciliation of this count with the counts used for our 2012 report on variation in payment to hospitals[45] and this report.

For the payment variations report, the hospital discharge dataset was not appropriate because it did not show payment by stay. We therefore constructed a dataset from data received directly from Blue Cross Blue Shield of Rhode Island, United HealthCare, Tufts Health Plan, Neighborhood Health Plan, and EOHHS (for Medicaid fee-for-service stays). For Medicare fee-for-service stays, we used data from the hospital discharge dataset that we priced using publicly available Medicare pricing logic. All together, the payment variations dataset included about 77% of the stays in the hospital discharge dataset. The other 23% included patients with other insurance (e.g., workers' compensation, military health care, self-insured employers not administered through BCBSRI, United, or Tufts), missing or unspecified data, and the net effect of Rhode Islanders receiving care outside the state and out-of-state residents receiving care in Rhode Island hospitals.

For this study, we started with the 106,951 stays in the payment variations dataset. In anticipation of a possible study of readmissions, we had asked the plans and EOHHS to include in their data files patient identification numbers that were uniquely assigned within each plan but were not beneficiary numbers, social security numbers, or other "real" numbers. Unique patient identification numbers were not included within the RIDOH hospital discharge dataset, so it was necessary for us to exclude 36,184 Medicare fee-for-service stays that were included in the payment variations dataset. We also excluded newborn and rehabilitation stays, for which the 3M potentially preventable readmissions algorithm was not designed. Lastly, we excluded stays in December 2010 that were not potentially preventable readmissions for index stays with a discharge date in the January-November period. That is, we analyzed index stays in an 11-month period by looking for potentially preventable readmissions in a 12-month period, thereby allowing one month of runout. The "PPR initial dataset" comprised 61,203 stays. Ideally, the initial dataset would also have included Medicare fee-for-service stays (and those of other insurers as well). The exclusions of newborns, rehabilitation patients, and stays in a runout period reflect the design of the study and are typical in a PPR study.

The initial dataset was then input into the 3M PPR software. The algorithm identified 2,950 "global exclusions" and 2,348 "non-events" that were excluded from subsequent analysis. Examples include patients with major metastatic cancer or other conditions for which no readmissions were assumed to be potentially preventable, patients who died, admissions for convalescence or other sub-acute care. A total of 90 stays, or 0.1%, were excluded because of grouping errors. The error percentage is similar to that of similar studies.

The PPR analytical dataset therefore comprised 55,815 stays. Of the total, 51,739 were index stays (that is, stays at risk of a potentially preventable readmission) and 4,076 were PPRs. The 4,076 PPR stays were included within 3,238 PPR chains. A PPR chain is identified when a patient has a PPR within 15 days of discharge. If the patient had a second PPR within 15 days of discharge from the first PPR, then one PPR chain would contain two PPR stays. The PPR rate is calculated as the number of PPR chains compared with the number of index stays, that is, 3,238 / 51,739 = 6.3%.

Table B.1
Reconciliation of Record Counts

	Stays	Dataset
RIDOH discharge dataset	139,743	RIDOH Discharge Dataset
Minus self-pay	6,039	RIDOH Discharge Dataset
Minus other insurance	23,036	RIDOH Discharge Dataset
Minus other/unspecified	3,351	Note 1
Minus chained or duplicate stays	313	Payment Variations Dataset
Minus error or ungroupable stays	53	Payment Variations Dataset
Equals dataset used in Payment Variations study	**106,951**	
Minus newborns	7,563	Payment Variations Dataset
Minus Medicare FFS	36,184	Payment Variations Dataset
Minus rehabilitation	618	Payment Variations Dataset
Minus December 2010 stays that were not readmissions	1,383	PPR Dataset
Equals PPR initial dataset	**61,203**	
Minus PPR grouping errors	90	PPR Initial Dataset
Minus PPR global exclusions	2,950	PPR Initial Dataset
Minus PPR non-events	2,348	PPR Initial Dataset
Equals PPR analytical dataset	**55,815**	
Index admissions	*51,739*	*PPR Analytical Dataset*
Potentially preventable readmissions	*4,076*	*PPR Analytical Dataset*

Notes:

1. The “other/unspecified” row was calculated to reconcile the RIDOH dataset with the dataset used in the Payment Variations study, which was drawn from the plans themselves. This line includes various miscellaneous categories from the RIDOH dataset as well as the net effect of excluding out-of-state patients in Rhode Island hospitals and including Rhode Island patients in out-of-state hospitals and any other discrepancies between the two datasets.
2. Stay counts for each line reflect the order in which the various datasets were created. A different order would result in different counts.

Notes

[1] K. Quinn, C. Courts and M. Day, *Variation in Payment for Hospital Care in Rhode Island*, Report to the Rhode Island Office of the Health Insurance Commissioner and the Executive Office of Health and Human Services (Cranston, RI: Xerox State Healthcare, Dec. 19, 2012).

[2] S. F. Jencks, M. V. Williams and E. A. Coleman, "Rehospitalizations Among Patients in the Medicare Fee-for-Service Program," *New England Journal of Medicine* 360:14(2009), pp. 1418-1428.

[3] Jencks, "Rehospitalizations Among Patients in Medicare."

[4] Jencks, "Rehospitalizations Among Patients in Medicare;" J.C. Gay, P.D. Hain, J.A. Grantham, B.R. Saville, "Epidemiology of 15-day Readmissions to a Children's Hospital," *Pediatrics* 127:6(2011), pp. e1505-e1512.

[5] E. A. Coleman, C. Parry, S. Chalmers and S. Min, "The Care Transitions Intervention: Results of a Randomized Controlled Trial," *Archives of Internal Medicine* 166 (Sept. 25, 2006); B. W. Jack, V. K. Chetty, D. Anthony et al., "A Reengineered Hospital Discharge Program to Decrease Rehospitalization: A Randomized Trial," *Annals of Internal Medicine* 150 (Feb. 3, 2009), pp. 178-187; M.D. Naylor, D.A. Brooten, R.I. Campbell, et al., "Transitional Care of Older Adults Hospitalized with Heart Failure: A Randomized, Controlled Trial," *Journal of the American Geriatric Society* 52(2004), pp. 675-684.

[6] L.O. Hansen, R.S. Young, K. Hinami et al.,"Interventions to Reduce 30-Day Rehospitalization: A Systematic Review," *Annals of Internal Medicine* 155:8(2011), pp. 520-529.

[7] Quinn et al., *Variation in Payment for Hospital Care.*

[8] For New York, see references in Note 17. For Florida, see R. L. Fuller, G. Atkinson, E. C. McCullough and J. S. Hughes, "Hospital Readmission Rates: The Impacts of Age, Payer, and Mental Health Diagnoses," *Journal of Ambulatory Care Management* 36:2(2013), pp. 147-155. For the national study, see A. Elixhauser and C. Steiner, *Readmissions to U.S. Hospitals by Diagnosis, 2010,* Statistical Brief #153 (Rockville, MD: AHRQ, April 2013).

[9] EOHHS data previously unpublished.

[10] Special Joint Commission to Study the Integration of Primary Care and Behavioral Health, Report to the Rhode Island Senate and House of Representatives (Providence: RI General Assembly, 2014). Available at www.rilin.state.ri.us/Reports/BH_and_PCP_Findings_and_Recommendations_final.pdf.

[11] Substance Abuse and Mental Health Services Administration (SAMHSA) with the Legal Action Center, "Frequently Asked Questions: Applying the Substance Abuse Confidentiality Regulations to Health Information Exchange (HIE)," www.samhsa.gov/healthprivacy/docs/ehr-faqs.pdf.

[12] EOHHS data previously unpublished.

[13] S.F. Jencks, "Defragmenting Care," *Annals of Internal Medicine* 153:11 (Dec. 7, 2010), 757-758.

[14] K.E. Joynt and A.K. Jha, "Thirty-day Readmissions—Truth and Consequences," *New England Journal of Medicine* 366:15(2012), 1366-1369.

[15] C. Van Walraven, C. Bennett, A. Jennings, et al., "Proportion of Hospital Readmissions Deemed Avoidable: A Systematic Review," *Canadian Medical Association Journal* 183:7 (2011), E391-E402.

[16] A.E. Boutwell and S.F. Jencks, *A Comparative Analysis of Three Population Based Rehospitalization Measurement Systems,* STAAR Issue Brief: *Reducing Barriers to Care Across the Continuum – Measuring Rehospitalizations at the State Level*, 2010.

[17] See, for example:

- Florida: www.FloridaHealthFinder.gov, especially the methodological discussion at www.floridahealthfinder.gov/Researchers/Reference/Methodology/Methodology.aspx.
- Illinois: http://www2.illinois.gov/hfs/SiteCollectionDocuments/PPRReport.pdf.
- New York: M. Lindsey, W. Patterson, K. Ray and P. Roohan, *Potentially Preventable Hospital Readmissions among Medicaid Recipients: New York State, 2007,* Statistical Brief No. 2 Albany, NY: New York Department of Health; M. Lindsey, W. Patterson, K. Ray and P. Roohan, *Potentially Preventable Hospital Readmissions among Medicaid Recipients with Mental Health and/or Substance Abuse Health Conditions Compared with All Others: New York State, 2007.* Statistical Brief No. 3. Albany, NY: NYDOH. See also W. Patterson, M. Lindsey and P. Roohan, *A Comparison of Potentially Preventable Hospital Readmissions where Preceding Admission Was a Behavioral Health, Medical or Surgical Admission: New York State Medicaid Program, 2007*. Statistical Brief No. 4. Albany, NY: NYDOH.
- Maryland: Maryland Health Services Cost Review Commission, *Maryland Hospital Preventable Re-Admissions*, http://www.hscrc.state.md.us/init_qi_MHPR.cfm.
- MedPAC: Medicare Payment Advisory Commission, *Report to the Congress: Promoting Greater Efficiency in Medicare* (Washington, DC: MedPAC, June 2007).

- Utah: Utah Department of Health, *Utah Health Status Update: Potentially Preventable Hospital Readmissions* (Salt Lake City, Department of Health, 2010). See also https://health.utah.gov/myhealthcare/reports/readmission/index.php. The technical documentation is at https://health.utah.gov/myhealthcare/reports/readmission/readmission_Tech.pdf*Program.*

[18] Section 2.2 is a summary of the PPR methodology developed by 3M Health Information Systems and used for this analysis. No changes were made to the methodology for this analysis.

[19] R. F. Averill, N. I. Goldfield, J. S. Hughes et al., *Potentially Preventable Readmissions Classification System Definitions Manual* (Wallingford, CT: 3M, October 2013).

[20] Readmission studies rely heavily on the patient discharge status on the hospital uniform bill. Some key discharge status values are 02 (transfer to acute care hospital), 07 (left against medical advice); 20 (expired) and 65 (transfer to psychiatric hospital or unit).

[21] A.E. Boutwell and S. Jencks, "It's Not Six of One, Half-Dozen the Other," presentation at the AcademyHealth 2011 annual meeting. Available at www.academyhealth.org/files/2011/tuesday/boutwell.pdf. The authors analyzed a dataset of 717,688 Massachusetts stays using the 3M PPR study's method, the Medicare method, and an all-cause method developed by UnitedHealth.

[22] Quinn et al., *Variation in Payment for Hospital Care in Rhode Island.* See also the technical appendix to that report, also available at www.ohic.ri.gov.

[23] At our request, the health plans did not provide us with actual patient identifiers. Instead, actual identifiers were scrambled so that individual patients were still uniquely identified in the dataset but the identifiers were not social security numbers, beneficiary numbers, or other "real" data.

[24] "Care category" is a categorization developed by Xerox for analyses such as this one. Each stay is assigned to a single care category based on the APR-DRG and the patient age. In purpose, care categories are similar to major diagnostic categories that are often used in hospital utilization. The chief differences are that age is used to separate pediatric from adult care and that there are fewer care categories (nine) than MDCs (25).

[25] Casemix is measured using APR-DRG relative weights as calculated by 3M from the Nationwide Inpatient Sample. Relative weights reflect the average hospital resources needed to treat a patient in a particular DRG relative to the hospital resources needed to treat the average patient overall. Note that later in this report we use "casemix" to reflect not only the APR-DRG assigned to the patient but also additional factors that are relevant to PPR risk, namely age group and the presence or absence of a MH/SA comorbidity.

[26] A. Agresti, *An Introduction to Categorical Data Analysis*, second edition (Hoboken, NJ: John Wiley & Sons, 2007), p. 40.

[27] In calculating the PPR rate, the numerator is the number of PPR chains and the denominator is the number of index admissions. The interpretation is that 6.3% of index admissions were followed by at least one potentially preventable readmission. Other studies define similar rates differently. Studies also vary in how deaths, transfers and other excluded stays are counted. Caution is appropriate when comparing results from different readmission studies.

[28] For five common oncology admissions, for example, AHRQ reported 30-day all-cause readmission rates as follows: secondary malignancies, 25%; benign neoplasm of uterus, 4%; maintenance chemotherapy, radiotherapy, 66%; cancer of bronchus, lung, 21%; cancer of colon, 16%. Elixhauser and Steiner, *Readmissions to U.S. Hospitals by Diagnosis,* p. 10.

[29] K. Nasir, Z. Lin, H. Bueno et al., "Is Same-Hospital Readmission Rate a Good Surrogate for All-Hospital Readmission Rate?" *Medical Care* 48:5 (May 2010), pp. 477-81. See also Fuller et al., "Hospital Readmission Rates."

[30] K. Dharmarajan, A.F. Hsieh, Z. Lin et al., "Diagnoses and Timing of 30-Day Readmissions after Hospitalization for Heart Failure, Acute Myocardial Infarction, or Pneumonia," *Journal of the American Medical Association* 309:4 (January 23/30, 2013), p. 358.

[31] Patterson et al., Statistical Brief No. 4, p. 4.

[32] Coleman et al., "The Care Transitions Intervention"; Jack et al., "A Reengineered Hospital Discharge Program."

[33] Dharmarajan et al., "Diagnoses and Timing of 30-Day Readmissions," p. 359.

[34] N. I. Goldfield, E. C. McCullough, J. S. Hughes et al., "Identifying Potentially Preventable Readmissions," *Health Care Financing Review* 30:1 (2008), pp. 75-91; Fuller et al., "Hospital Readmission Rates."

[35] Re Florida, see Fuller et al., "Hospital Readmission Rates." Re New York, see Lindsey et al., Statistical Brief No. 3.

[36] Centers for Medicare and Medicaid Services and National Center for Health Statistics*, ICD-9-CM Official Guidelines for Coding and Reporting*, p. 91. Available at www.cdc.gov/nchs/data/icd/icd9cm_guidelines_2011.pdf.

[37] For Medicaid managed care and Medicaid fee-for-service combined, there were 17,378 index admissions, 1,163 actual PPR chains and 891 expected PPR chains, for an actual/expected ratio of 1.31. The 23% difference equals (1.31 / 1.06) – 1 and is expressed as a percentage.

[38] Fuller et al., "Hospital Readmission Rates," p. 152.

[39] See, for example, Fuller et al., "Hospital Readmission Rates;" Qian Gu, L. Koenig, J. Faerberg, C. Rossi Steinberg et al., "The Medicare Hospital Readmissions Reduction Program: Potential Unintended Consequences for Hospitals Serving Vulnerable Populations," *Health Services Research,* published online 13 January 2014.

[40] Boutwell and Jencks, *A Comparative Analysis*.

[41] Various all-cause approaches take various approaches to, for example, excluding patients who left against medical advice, who died, or who had certain diseases. As a general statement, however, these exclusions are not at the level of detail of the PPR approach.

[42] C. Feudtner, J.E. Levin, R. Srivastava et al., "How Well Can Hospital Readmission Be Predicted in a Cohort of Hospitalized Children? A Retrospective, Multicenter Study," *Pediatrics* 123:1(2009), pp. 286-293; J. Billings, J. Dixon, T. Mijanovich and D. Wennberg, "Case Finding for Patients at Risk of Readmission to Hospital: Development of Algorithm to Identify High Risk Patients," *BMJ* 333 (Aug. 10, 2006).

[43] National Quality Forum, *Measure Evaluation Criteria,* Available at www.qualityforum.org/docs/measure_evaluation_criteria.aspx#scientific.

[44] NQF has therefore convened an expert panel to consider future policy on risk adjustment and socioeconomic status. See also the discussion in Medicare Payment Advisory Commission, "Refining the Hospital Readmissions Reduction Program" in *Report to the Congress: Medicare and the Health Care Delivery System* (Washington, DC: MedPAC, June 2013), pp. 106-110.

[45] Quinn et al., *Variation in Payment for Hospital Care in Rhode Island*.