Heart Attack Readmissions in Virginia

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Highlights:

- In 2014, almost 11.2 percent of patients admitted to Virginia hospitals with a heart attack (AMI) were readmitted to the hospital within 30 days of their initial discharge.

- Readmissions following an AMI index admission resulted in about $50.5 million in hospital charges in 2014.

- Patients admitted for AMI are on average younger and have fewer comorbidities than those admitted with heart failure and pneumonia.

Heart attack or acute myocardial infarction (AMI) is one of the most common diagnoses associated with inpatient hospitalizations among adults. Heart attacks resulted in almost 609,000 hospital stays nationwide in 2014 and were one of the top 10 reasons for hospitalizations among adults aged 45 and over. In that year, hospital stays due to AMI cost a total of almost $12.3 billion.[1] Moreover, readmission to the hospital shortly after an initial heart attack hospitalization is fairly common. More than 51,000 Medicare patients were readmitted following an AMI-related hospital stay in 2011. Only seven other conditions were associated with more hospital readmissions in that year.[2]

This brief examines the characteristics of patients admitted to Virginia acute care hospitals for AMI and then readmitted within 30 days during 2014. Several questions are examined. First, how many patients are readmitted to Virginia hospitals following initial admissions for AMI and what is the cost of treating them? Second, how do readmission rates vary by patient sex, age, comorbid conditions, and geography? These questions can provide insight on patterns of hospitalization treatment for heart attacks across the Commonwealth.

This brief also examines a third question, namely, how do the age and comorbid conditions of patients admitted for AMI differ from those admitted for pneumonia and heart failure? This question is of interest in light of recent research findings on the Hospital Readmission Reduction Program (HRRP), which imposes penalties on hospitals with high readmission rates for patients with certain conditions.[3] Recent research has found that, in Virginia, the HRRP reduced readmissions for patients with AMI, but failed to do so for patients with heart failure and pneumonia.[4] This brief examines whether differences in patients' ages and comorbidities contribute to the differences in readmission rate reductions across these conditions.

The Number and Costs of AMI-Related Readmissions

In 2014, there were a total of 12,158 initial AMI hospitalizations of patients aged 40 and older that took place at short-term acute care hospitals participating in Medicare's inpatient prospective payment system in Virginia. A small number of these (219) are excluded from the analysis because it is not possible to ascertain whether or not a readmission took place due to missing patient identifying information such as the Social Security Number. Of the remaining 11,939 AMI hospitalizations for this age group, 1,343 hospitalizations resulted in a readmission within 30 days of the initial discharge, yielding a 30-day readmission rate of about 11.2 percent.

Readmissions related to AMI resulted in about $50.5 million in hospital charges. This equates to $11.7 million in costs to the healthcare system, using hospital cost-to-charge ratios from the Centers for Medicare & Medicaid Services (CMS).[5] As shown in Exhibit 1, a large share of charge can be attributed to patients with Medicare as the primary payer -- $36.1 million in charges or approximately $8.3 million in costs. Patients with private insurance as the primary payer had the second largest share of these charges at $8.2 million ($1.9 million in costs), followed by Medicaid patients at $2.7 million ($0.65 million in costs), and then self-pay patients at $1.7 million ($0.37 million in costs).[6]

Exhibit 1. Total Charges Due to 30-Day Readmission Following 2014 Initial Admissions for AMI to Patients Age 40 and Older, by Payer, in Millions of Dollars
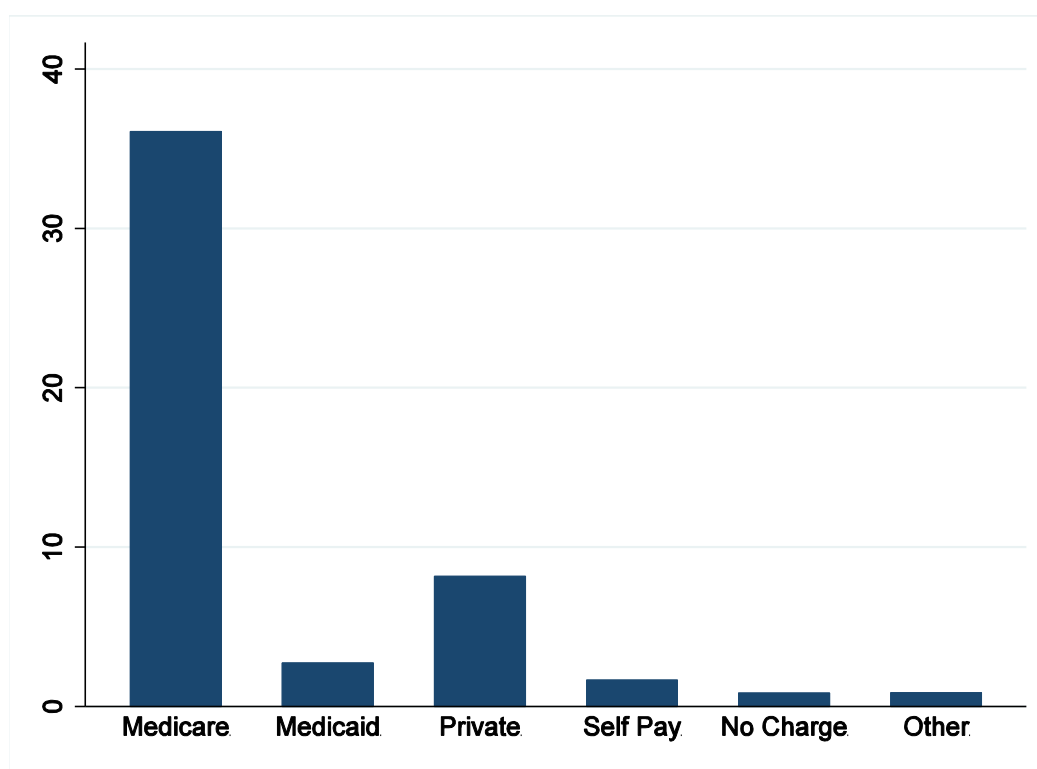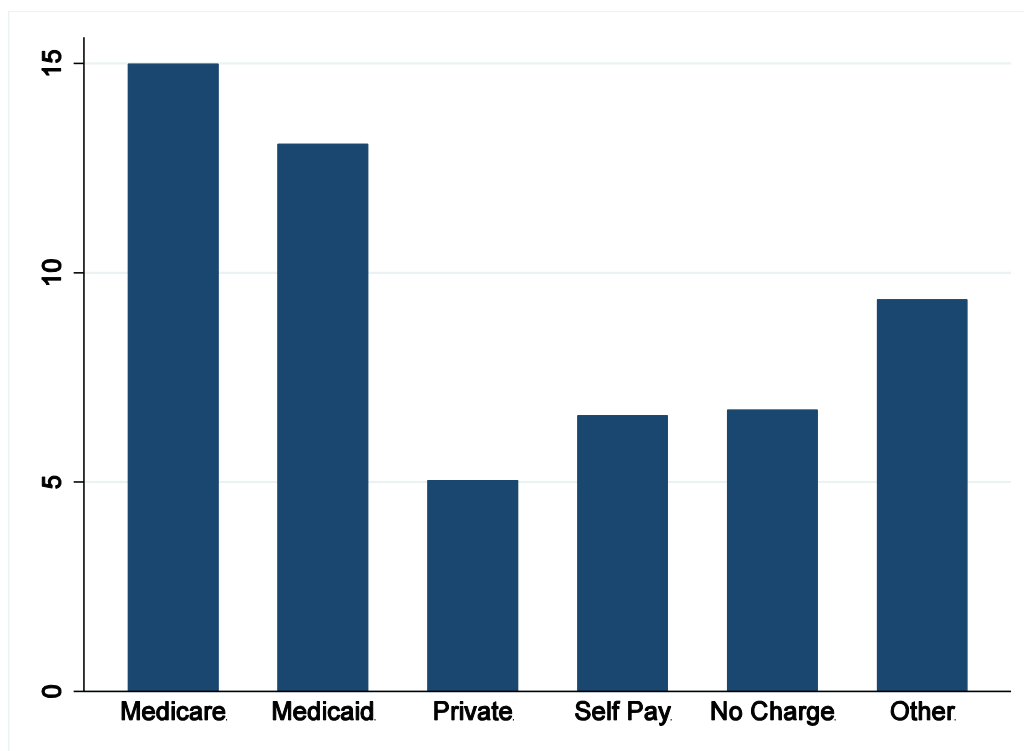

Source: Schroeder Center analysis of Virginia Health Information data

Average charges per hospitalization also vary by payer. The average charge for hospitalization were highest for patients with private insurance ($46,328), followed by those with Medicaid ($44,262), patients who self-pay ($41,463), and those with Medicare ($35,566).

Readmission rates were highest for Medicare patients at 15.0 percent, as shown in Exhibit 2. The rate was lower for Medicaid patients at 13.1 percent, while it was only 5.0 percent for patients with private insurance.

Exhibit 2. Readmission Rates for 2014 Initial Admissions for AMI to Patients Age 40 and Older, by Primary Payer

Source: Schroeder Center analysis of Virginia Health Information data

Characteristics of Patients Readmitted for AMI

Demographic and clinical traits of patients readmitted for AMI are reported in Exhibit 3. Females in the sample had higher readmission rates for heart attack than males. Female patients were readmitted following about 13.9 percent of discharges, while males were only readmitted following about 9.5 percent of initial hospitalizations of adults age 40 and over. Readmission rates also rise with patients' ages. While patients in their 40s and 50s have readmission rates of 7.0 and 7.3 percent, respectively, older patients were much more likely to be readmitted. More than 17.1 percent of patients in their 80s were readmitted following an AMI admission, while more than an eighth of those in their 70s were readmitted.

Exhibit 3. Readmission Rates for 2014 Initial Admissions for AMI to Patients Age 40 and Older by Patient Characteristics

	All Patients Aged 40 and Older		Medicare Patients Aged 65 and Older	
	Number of Observations	Readmission Rate	Number of Observations	Readmission Rate
Sex				
Male	7,255	9.5%	3,129	13.5%
Female	4,684	13.9%	2,824	16.3%
Age				
40-49	1,178	7.0%	n.a.	n.a.
50-59	2,672	7.3%	n.a.	n.a.
60-64	1,559	8.7%	n.a.	n.a.
65-69	1,550	11.5%	1,239	12.5%
70-79	2,588	13.4%	2,394	13.9%
80-89	1,823	17.1%	1,767	17.0%
90+	569	16.7%	553	17.2%
Hospital Health Planning Region				
Northern Virginia	1,724	9.6%	757	13.0%
Eastern Virginia	2,598	10.4%	1,204	14.7%
Northwest Virginia	2,326	11.6%	1,185	14.9%
Central Virginia	2,339	11.7%	1,138	15.2%
Southwest Virginia	2,952	12.4%	1,669	15.5%
Type of Comorbid Conditions				
Cancer	386	16.8%	275	17.8%
Chronic Cardiovascular Disease	11,056	11.5%	5,565	15.2%
Chronic Liver Disease	176	14.8%	69	20.3%
Chronic Renal Disease	2,449	19.8%	1,728	20.3%
Chronic Diabetes	956	18.9%	498	21.1%
Chronic Pulmonary Disease	2,319	16.3%	1,321	19.1%
Cerebrovascular Degeneration	932	15.3%	719	16.3%
Number of Comorbid Conditions				
0	531	5.8%	190	6.3%
1	6,380	7.4%	2,622	10.5%
2	3,461	15.0%	2,075	17.9%
3	1,315	19.9%	879	20.7%
4	233	25.8%	169	22.5%
5	19	21.1%	18	22.2%
Total	11,939	11.3%	5,953	14.8%

Source: Schroeder Center analysis of Virginia Health Information data

Patients are more likely to be readmitted for AMI when they have other comorbid conditions, which may make their cases particularly complicated to treat. For example, 16.3 percent of AMI patients age 40 and older with chronic pulmonary disease are readmitted, compared to 11.3 percent overall. Similarly, 18.9 percent of AMI patients with chronic diabetes and 19.8 percent with chronic renal disease are readmitted.

The likelihood of readmission also varied across the state. Patients treated at hospitals in the Southwest, Northwest, and Central Virginia health planning regions had readmission rates above 11 percent, while those treated in the Northern Virginia region had a readmission rate of about 9.6 percent.

Comparison of AMI, Heart Failure and Pneumonia Patients

A recent study found that the HRRP reduced readmissions for Virginia patients with AMI, but failed to do so for patients with heart failure and pneumonia.[7] Looking at the characteristics of patients initially admitted for AMI, heart failure, or pneumonia treatment shows some significant differences in patients' ages and comorbid conditions. This variation may contribute to different responses to the Hospital Readmissions Reductions Program.

Exhibit 4 shows the average age and share of patients with different comorbid conditions using a sample of initial hospitalizations to patients age 40 and older. Exhibit 5 shows the same measures (average age and share of patients with different comorbid conditions) for a sample of initial hospitalizations to patients age 65 and older and with Medicare as the primary payer.

Exhibit 4. Rates of Comorbid Conditions Among Patients Aged 40 and Over Admitted with AMI, Heart Failure, and Pneumonia

	AMI	Heart Failure	Pneumonia
Cancer	3.2%	4.5%*	10.7%*
Chronic Cardiovascular Disease	92.6%	97.2%*	52.5%*
Chronic Liver Disease	1.5%	2.7%*	2.7%*
Chronic Renal Disease	20.5%	50.0%*	22.6%*
Chronic Diabetes	8.0%	13.3%*	6.6%*
Chronic Pulmonary Disease	19.4%	36.9%*	47.2%*
Cerebrovascular Degeneration	7.8%	10.8%*	16.2%*
Average Age	67	73*	71*
Total	11,939	24,497	13,085

Source: Schroeder Center analysis of Virginia Health Information data
Note: * indicates significant differences at the 0.01 level compared to the AMI sample

Exhibit 5. Rates of Comorbid Conditions Among Medicare Patients Aged 65 and Over Admitted with AMI, Heart Failure, and Pneumonia

	AMI	Heart Failure	Pneumonia
Cancer	4.6%	5.1%	11.0%*
Chronic Cardiovascular Disease	93.5%	98.0%*	62.6%*
Chronic Liver Disease	1.2%	2.1%*	1.6%**
Chronic Renal Disease	29.0%	51.2%*	26.9%*
Chronic Diabetes	8.4%	11.2%*	6.2%*
Chronic Pulmonary Disease	22.2%	37.1%*	46.5%*
Cerebrovascular Degeneration	12.1%	13.1%**	20.6%*
Average Age	77	80*	79*
Total	5,953	16,427	8,100

Source: Schroeder Center analysis of Virginia Health Information data
Note: * indicates significant differences at the 0.01 level (** at the 0.05 level) compared to the AMI sample

Of patients aged 40 and older from short-term acute care hospitals participating in Medicare's inpatient prospective payment system, there were 11,939 AMI index admissions, 13,085 pneumonia index admissions, and 24,497 heart failure index admissions. Among those patients aged 65 and older and covered by Medicare, there were 5,953 AMI index admissions, 8,100 pneumonia index admissions, and 16,427 heart failure index admissions.

Age
Comparing hospitalizations occurring to patients aged 40 and older, we find that AMI patients are significantly younger than those with heart failure and pneumonia. On average, patients among the age 40 and older sample admitted with AMI were 67 years old, compared to 73 and 71 years old among those with heart failure and pneumonia respectively, a statistically significant difference. This pattern also holds for patients age 65 and older and covered by Medicare.

Comorbidities
Comparing hospitalizations occurring to patients aged 40 and older, we find that patients admitted for AMI are less likely to have certain comorbid conditions than those admitted with heart failure or pneumonia. AMI patients were about 30 percent less likely to have cancer as heart failure patients and 70 percent less likely as pneumonia patients. Patients with AMI were also about half as likely to have chronic liver disease when compared to patients with heart failure and pneumonia. Similarly, AMI patients were also about 60 percent less likely to have chronic renal disease as heart failure patients and were also less likely to have cerebrovascular disease compared to those with heart failure and pneumonia. This general pattern also holds for patients age 65 and older and covered by Medicare, although the size of the differences are smaller in some cases.

Data and Methodology

The data on admissions and readmissions at Virginia hospitals used in this research come from the Patient Level Data (PLD) and Readmissions and Transfers (RATs) data produced by Virginia Health Information (VHI). The PLD is a census of inpatient hospital discharges occurring at Virginia hospitals, and the RATs data allow linkage of each discharge to any prior or subsequent discharge occurring within 90 days. Virginia Health Information requests that the following disclosure be included in reports using the data: VHI has provided non-confidential patient level information used in this report, which it has compiled in accordance with Virginia law but which it has no authority to independently verify. By using this file, report, publication, or database, the user agrees to assume all risks that may be associated with or arise from the use of inaccurate data. VHI cannot and does not represent that the use of VHI's data was appropriate for this report or endorse or support any conclusions or inferences that may be drawn from the use of VHI's data.

To construct the analytical samples used in this report, we first select discharges from hospitals paid under the Inpatient Prospective Payment System (IPPS) for index admission and according to the principal diagnosis code of the discharge. In this way, our definitions of index admissions adhere closely to published definitions by CMS.

We follow details in the construction of readmission rates for each condition found in technical reports prepared for CMS. For AMI index admissions, we selected discharges with a principal diagnosis of the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) code 410.xx, excluding those with 410.x2, which is a subsequent episode of AMI care.[8] For heart failure index admissions, we selected discharges with a principal diagnosis of ICD-9-CM code of 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.xx.[9] For pneumonia index admissions, we selected discharges with a principal ICD-9-CM code of 480.0–480.3, 480.8, 480.9, 481, 482.0–482.2, 482.30–482.32, 483.39–482.41, 482.49, 482.81–482.84, 482.89, 483, 483.1, 483.8, 485, 486, and 487.0.[10]

Specifically, we exclude discharges in which the patient died in the hospital, was discharged against medical advice, or was discharged or transferred to another acute care facility; we also exclude discharges preceded by another admission for the corresponding condition (AMI, heart failure, or pneumonia) in the prior 30 days (because that discharge is then a readmission, not an index admission). For AMI admissions, we also exclude cases where the patient was discharged on the same day of admission, and we do not count potentially planned/staged readmissions as readmissions unless they include specific non-elective procedures and diagnosis codes.

The RATs dataset allows us to observe prior hospitalizations that took place as many as 90 days before an admission for all hospitalizations in the PLD records, even for those hospitalizations in the first quarter of 2014. Note that if an admission for AMI follows 10 days after a discharge for pneumonia, that admission is both an index admission for AMI and a readmission for pneumonia. On the other hand, if an admission for AMI follows

10 days after a previous admission for AMI, that admission is excluded as it is not a true index admission but rather a readmission. This is because an admission for AMI can be an index admission or a readmission, but not both. Readmissions for heart failure and pneumonia are restricted in a similar manner.

References

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[3] "The Hospital Readmissions Reductions (HRR) Program," Centers for Medicare & Medicaid Services, https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/HRRP/Hospital-Readmission-Reduction-Program.html, accessed November 28, 2016.

[4] Mellor J, Daly M, Smith M, "Does It Pay to Penalize Hospitals for Excess Readmissions? Intended and Unintended Consequences of Medicare's Hospital Readmissions Reductions Program," *Health Economics* (2016), DOI: 10.1002/hec.3382.

[5] The all-payer cost-to-charge ratio was calculated using CMS Healthcare Report Information System (HCRIS) Worksheet C Part I. 2014 Medicare Cost Reports do not contain a costs and charges information for Mountain View Regional Medical Center in Norton, Virginia. We assign the mean cost-to-charge ratio among Virginia short-term acute facilities (0.25) to this facility.

[6] Self-pay excludes "No charge", "other" and "unknown."

[7] Mellor J, Daly M, Smith M, "Does It Pay to Penalize Hospitals for Excess Readmissions? Intended and Unintended Consequences of Medicare's Hospital Readmissions Reductions Program," *Health Economics* (2016), DOI: 10.1002/hec.3382.

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