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Readmissions for Heart Attack, 2009

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Introduction

Readmission following an inpatient hospitalization is fairly common and costly.[1] High rates of hospital readmissions and unexplained variation in those rates may indicate problems in quality of care, transitions of care, and outpatient management following discharge. While some readmissions may be unavoidable, reducing hospital readmissions has been an objective of several recent federal efforts to improve quality and reduce costs in the Medicare program.[2]

In 2009, there were 633,000 inpatient stays for heart attacks in the United States.[3] Heart attack is among the top ten reasons for hospitalization among adults age 45 and over and is a high risk condition with an inpatient mortality rate of about 6 percent. Heart attack is one of the conditions for which the Centers for Medicare and Medicaid Services publishes hospital-specific Medicare readmission rates because it is a common reason for Medicare hospitalizations and has been found to have a relatively high readmission rate.[4] Studies of readmission rates for all patients, regardless of payer, are rare.

This Statistical Brief examines readmissions within 30 days of a hospital stay for heart attack (i.e., acute myocardial infarction (AMI)) among all patients age 18 years and older. Differences in 30-day readmission rates by patient age, sex, and community-level income are presented, along with information on costs of AMI admissions and readmissions and the reason for the readmission. Examining characteristics that explain variability in readmission rates can help to identify opportunities for targeted interventions for hospital patients at risk for readmission, such as patients hospitalized for a heart attack.

The Statistical Brief provides all-payer, national estimates of AMI readmission rates. The readmission rate is defined as the percentage of AMI admissions with at least one readmission to a same or different hospital within 30 days. In addition to overall readmission rates, three reasons for readmissions are examined—a

Highlights

- Among index hospital admissions for heart attack (AMI) in 2009, 17.1 percent were followed by a readmission within 30 days: 1.6 percent were readmitted for a new AMI diagnosis, 2.0 percent were readmitted for a scheduled surgery of PTCA or CABG, 2.3 percent were readmitted for heart failure and 11.2 percent were readmitted for another reason.
- The readmission rate was 50 percent higher for those age 65 years and over than for younger adults. However, the older adults had a 22 percent lower readmission rate for scheduled PTCA or CABG.
- Readmission rates were 28 percent higher for females than males, but their readmission rate for scheduled PTCA and CABG surgery was 30 percent lower than males.
- Readmission rates were 11 percent higher for patients residing in low income communities compared to those residing in high income communities.

[1] Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare Fee-for-Service program. *NEJM* 2009;360:1418-1428.
[2] Kocher R P, Adashi EY. Hospital readmissions and the Affordable Care Act. Paying for coordinated quality care. *JAMA* 2011; 306(16):1794-1795.
[3] HCUPnet. Healthcare Cost and Utilization Project (HCUP). 2009. Agency for Healthcare Research and Quality, Rockville, MD. Available at http://hcupnet.ahrq.gov. (Accessed July 12, 2012).
[4] Krumholz HM, Lin Z, Drye EE, Desai MM, Han LF, Rapp MT, Mattera JA, Normand SL. An administrative claims measure suitable for profiling hospital performance based on 30-day all-cause readmission rates among patients with acute myocardial infarction. *Circ Cardiovasc Qual Outcomes* 2011;4(2):243-52.

readmission for a new AMI, a readmission for a scheduled percutaneous transluminal coronary angioplasty (PTCA) or coronary artery bypass graft (CABG) surgery to improve blood flow to the heart, and a readmission for any other condition or surgery (but not a new AMI, PTCA, or CABG). Differences noted in the text are at least 10 percent.

Findings

Of the 515,500 index AMI admissions tracked for this analysis, 17.1 percent were followed by a readmission within 30 days (table 1). For 1.6 percent of the index admissions the reason for readmission was a new AMI, while for 2.0 percent the reason was a scheduled PTCA or CABG[5], for 2.3 percent it was heart failure or shock and the remaining 11.2 percent of index admissions were readmitted for other conditions and procedures.

Average costs associated with the initial AMI admissions were higher ($20,800) than average costs for the readmissions ($13,200). But the average cost of the readmission varied according to the reason for readmission. Readmissions for scheduled PTCA or CABG procedures had the highest average costs per stay ($23,400), readmissions for a new AMI were next most costly ($17,600), while readmissions for heart failure were the least costly ($7,600).

Table 1. Readmissions within 30 days among adult AMI admissions by reason for readmission, 2009

			Reason for readmission			
	Index AMI admissions	All reasons	New AMI	Scheduled PTCA or CABG surgery	Heart failure or shock	Other reasons
Number of admissions	515,500	88,000	8,100	10,400	11,800	57,700
Percentage readmitted	--	17.1	1.6	2.0	2.3	11.2
Mean cost per stay	$20,800	$13,200	$17,600	$23,400	$7,600	$11,900

Source: Weighted national estimates from a readmissions analysis file derived from the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID), 2009, Agency for Healthcare Research and Quality (AHRQ), based on data collected by individual States and provided to AHRQ by the States.

30-day readmission rates by patient characteristics and reason for readmission, 2009

Table 2 provides 30-day readmission rates by patient characteristics and reason for readmission among patients tracked with an index AMI admission. The overall readmission rate for patients age 65 years and older was about 50 percent higher than among younger patients ages 18–64 years (20.1 percent compared to 13.3 percent). The pattern varied by reason for readmission. The readmission rate for heart failure following an index AMI was more than twice as high for older patients than younger patients, whereas the readmission rate for a scheduled PTCA or CABG was 22 percent lower among older patients than among younger patients.

Readmissions rates were 28 percent higher for females than for males but this pattern also varied with the reason for readmission. Females had a 67 percent higher readmission rate for heart failure, but their readmission rate for scheduled PTCA or CABG was about 30 percent lower than for males. Readmission rates were also 11 percent higher for patients from low income communities compared to high income communities and their readmission rate was consistently higher across the reasons for readmission.

[5] Note that unscheduled PTCAs or CABGs may have been performed in the groups labeled "new AMI" or "other reason."

Table 2. 30-day readmission rates by patient characteristics and reason for readmission among AMI admissions, 2009

Patient characteristic	All reasons	Reason for readmission			
		New AMI	Scheduled PTCA or CABG surgery	Heart failure or shock	Other reasons
Total	17.1	1.6	2.0	2.3	11.2
Age (years)					
18–64	13.3	1.2	2.3	1.2	8.6
65+	20.1	1.9	1.8	3.2	13.2
Sex					
Male	15.4	1.4	2.3	1.8	9.9
Female	19.7	1.9	1.6	3.0	13.2
Community-level Income*					
Quartile 1 (lowest income)	18.2	1.7	2.1	2.5	11.9
Quartile 2	16.9	1.6	2.1	2.4	10.9
Quartile 3	16.4	1.5	2.0	2.1	10.9
Quartile 4 (highest income)	16.4	1.5	2.0	2.1	10.9

Source: Weighted national estimates from a readmissions analysis file derived from the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID), 2009, Agency for Healthcare Research and Quality (AHRQ), based on data collected by individual States and provided to AHRQ by the States.

*Median household income for the patient's ZIP Code of residence.

Most frequent reasons for 30-day readmissions among AMI patients, 2009

Table 3 shows the most frequent reasons for a 30-day readmission following AMI. In 2009, heart failure and shock was the most common reason (13.4 percent) for these readmissions, followed by a scheduled PTCA or CABG surgery (11.8 percent) and a new AMI (9.2 percent). Other common reasons included circulatory disorders (except AMI) (4.0 percent), chest pain (3.8 percent), atherosclerosis (3.0 percent), cardiac arrhythmia and conduction disorders (2.6 percent), and septicemia or severe sepsis (2.5 percent).

Table 3. Most frequent reasons for 30-day readmission following an index AMI admission, 2009

Reason for Readmission	Frequency	Percent
Total readmissions	88,000	100.0
Heart failure or shock	11,800	13.4
PTCA or CABG (scheduled)	10,400	11.8
New AMI	8,100	9.2
Circulatory disorders (except AMI) with cardiac catheterization	3,500	4.0
Chest pain	3,300	3.8
Atherosclerosis	2,600	3.0
Cardiac arrhythmia and conduction disorders	2,300	2.6
Septicemia or severe sepsis	2,200	2.5
G.I. hemorrhage	2,100	2.4
Renal failure	2,100	2.4
Simple pneumonia	1,800	2.0
Esophagitis, gastroenteritis, and miscellaneous digestive disorders	1,700	1.9

Source: Weighted national estimates from a readmissions analysis file derived from the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID), 2009, Agency for Healthcare Research and Quality (AHRQ), based on data collected by individual States and provided to AHRQ by the States.

Data Source

The estimates in this Statistical Brief are based upon a readmission analysis file that was created using the HCUP State Inpatient Databases (SID) from 16 States (AR, CA, FL, GA, HI, LA, MA, MO, NE, NH, NM, NY, SC, TN, UT, and WA) with reliable, verified synthetic patient identifiers that can be used to track a person across hospitals within a State. These 16 States were geographically dispersed and account for 43 percent of the total U.S. resident population and 42 percent of the total U.S. hospitalizations. The study population in this readmission analysis file included discharges from community, non-rehabilitation, non-specialty hospitals. Weights for national estimates were developed using post-stratification on hospital characteristics (Census region, urban-rural location, teaching capabilities, bed size, and control/ownership) and patient age groups. The readmission analysis file included 12.7 million discharges.

Definitions

ICD-9-CM Diagnoses and Medicare-Severity Diagnosis-Related Groups (MS-DRGs)
The principal diagnosis is that condition established after study to be chiefly responsible for the patient's admission to the hospital. ICD-9-CM is the International Classification of Diseases, Ninth Revision, Clinical Modification, which assigns numeric codes to diagnoses. There are about 14,000 ICD-9-CM diagnosis codes. MS-DRGs comprise a patient classification system that categorizes patients into groups that are clinically coherent and homogeneous with respect to resource use. MS-DRGs group patients according to diagnosis, type of treatment (procedures), age, and other relevant criteria. Each hospital stay has one DRG assigned to it.

For the purpose of this Statistical Brief:

- AMI and new AMI are defined as an ICD-9-CM principal diagnosis of 410.00–410.91, but not equal to ICD-9-CM 410.x2 indicating a subsequent episode of care.
- Scheduled PTCA or CABG (but not a new AMI) is defined as any procedure of PTCA (00.66, 36.06, 36.07) or CABG (36.10-36.16), but excluding discharges with the following principal diagnoses that suggest that the surgery may have been unscheduled: heart failure (402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.xx), AMI (410.xx, except 410.x2), unstable angina (411.xx), arrhythmia (427.xx, except 427.5), and cardiac arrest (427.5).
- Heart failure and shock is defined by MS-DRGs of Heart Failure and Shock with and without complications (MS-DRGs 291–293).
- "Other reasons for readmission" is defined as stays with no new AMI, or unscheduled surgery of PTCA or CABG, or MS-DRG of heart failure and shock.
- Reasons for readmission in table 3 (other than AMI, PTCA or CABG and heart failure or shock, which are described above) are based on MS-DRGs in which MS-DRGs involving similar conditions have been collapsed (e.g., collapsed across MS-DRGs with and without complications).

Readmission
The 30-day readmission rate is defined as the number of AMI admissions (as defined above) for which there was at least one subsequent hospital admission within 30 days divided by the total number of AMI admissions between January and November 2009. That is, when a patient is discharged from the hospital with a principal diagnosis of AMI, they are followed for 30 days in the data. If any readmission to the same or different hospital occurs during this time period, the admission is counted as having a readmission. No more than one readmission is counted within the 30-day period since the outcome measure assessed here is "percentage of admissions who are readmitted." If a patient was transferred to a different hospital on the same day or was transferred within the same hospital, the two events were combined as a single stay and the second event was not counted as a readmission. That is, transfers were not considered a readmission. In the case of AMI admissions for which there was more than one readmission in the 30-day period, the data presented in this Statistical Brief reflect the characteristics, costs, and associated diagnoses of the first readmission.

Every qualifying hospital stay with AMI as the principal diagnosis is counted as a separate index (starting point) admission. Thus a single patient can be counted multiple times during the course of the January to November observation period. In addition, AMI index admissions do not require a prior "clean period" with

no hospitalizations; that is, a hospital stay may be both a readmission for a prior stay and the index admission for a subsequent readmission. AMI admissions were disqualified from the analysis as index admissions if they could not be followed for 30 days for one of the following reasons: (1) admissions in which the patient died in the hospital, (2) admissions missing information on length of stay, and (3) admissions discharged in December of 2009.

Types of hospitals included in HCUP
HCUP is based on data from community hospitals, defined as short-term, non-Federal, general, and other hospitals, excluding hospital units of other institutions (e.g., prisons). Excluded are long-term care, rehabilitation, psychiatric, and alcoholism and chemical dependency hospitals. The readmission analysis file used for this Statistical Brief also excludes specialty hospitals such as obstetrics-gynecology, cancer, cardiac, orthopedic, surgical, ear-nose-throat, and other specialty hospitals because these hospitals have unique patient mix and a disproportionally large number of out-of-state patients. While the exclusion of the cardiac specialty hospitals may have affected the presented readmission rates, there were only five cardiac specialty hospitals excluded, accounting for 0.2 percent of the total discharges in the analysis file.

Costs and charges
Total hospital charges were converted to costs using HCUP Cost-to-Charge Ratios based on hospital accounting reports from the Centers for Medicare & Medicaid Services (CMS).[6] *Costs* will reflect the actual expenses incurred in the production of hospital services, such as wages, supplies, and utility costs; *charges* represent the amount a hospital billed for the case. For each hospital, a hospital-wide cost-to-charge ratio is used. Hospital charges reflect the amount the hospital billed for the entire hospital stay and do not include professional (physician) fees. For the purposes of this Statistical Brief, costs are reported to the nearest hundred.

Median community-level income
Median community-level income is the median household income of the patient's ZIP Code of residence. The cut-offs for the quartile designation are determined using ZIP Code demographic data obtained from Claritas.The income quartile is missing for homeless and foreign patients.

About HCUP

HCUP is a family of powerful health care databases, software tools, and products for advancing research. Sponsored by the Agency for Healthcare Research and Quality (AHRQ), HCUP includes the largest all-payer encounter-level collection of longitudinal health care data (inpatient, ambulatory surgery, and emergency department) in the United States, beginning in 1988. HCUP is a Federal-State-Industry Partnership that brings together the data collection efforts of many organizations—such as State data organizations, hospital associations, private data organizations, and the Federal government—to create a national information resource.

HCUP would not be possible without the contributions of the following data collection Partners from across the United States:

Alaska State Hospital and Nursing Home Association
Arizona Department of Health Services
Arkansas Department of Health
California Office of Statewide Health Planning and Development
Colorado Hospital Association
Connecticut Hospital Association
Florida Agency for Health Care Administration
Georgia Hospital Association
Hawaii Health Information Corporation
Illinois Department of Public Health

[6] HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2001–2009. U.S. Agency for Healthcare Research and Quality, Rockville, MD. Available at http://www.hcup-us.ahrq.gov/db/state/costtocharge.jsp. Updated August 2011. (Accessed July, 2012).

Indiana Hospital Association
Iowa Hospital Association
Kansas Hospital Association
Kentucky Cabinet for Health and Family Services
Louisiana Department of Health and Hospitals
Maine Health Data Organization
Maryland Health Services Cost Review Commission
Massachusetts Division of Health Care Finance and Policy
Michigan Health & Hospital Association
Minnesota Hospital Association
Mississippi Department of Health
Missouri Hospital Industry Data Institute
Montana MHA - An Association of Montana Health Care Providers
Nebraska Hospital Association
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New Jersey Department of Health
New Mexico Department of Health
New York State Department of Health
North Carolina Department of Health and Human Services
Ohio Hospital Association
Oklahoma State Department of Health
Oregon Association of Hospitals and Health Systems
Oregon Health Policy and Research
Pennsylvania Health Care Cost Containment Council
Rhode Island Department of Health
South Carolina State Budget & Control Board
South Dakota Association of Healthcare Organizations
Tennessee Hospital Association
Texas Department of State Health Services
Utah Department of Health
Vermont Association of Hospitals and Health Systems
Virginia Health Information
Washington State Department of Health
West Virginia Health Care Authority
Wisconsin Department of Health Services
Wyoming Hospital Association

About the SID

The HCUP State Inpatient Databases (SID) are hospital inpatient databases from data organizations participating in HCUP. The SID contains the universe of the inpatient discharge abstracts in the participating HCUP States, translated into a uniform format to facilitate multistate comparisons and analyses. Together, the SID encompasses 95 percent of all U.S. community hospital discharges in 2009. The SID can be used to investigate questions unique to one State; to compare data from two or more States; to conduct market area variation analyses; and to identify State-specific trends in inpatient care utilization, access, charges, and outcomes.

For More Information

For more information about HCUP, visit http://www.hcup-us.ahrq.gov/.

For additional HCUP statistics, visit HCUPnet, our interactive query system, at http://hcupnet.ahrq.gov/.

For information on other hospitalizations in the United States, download *HCUP Facts and Figures: Statistics on Hospital-Based Care in the United States in 2009*, located at http://www.hcup-us.ahrq.gov/reports.jsp.

For more information on the SID and using HCUP files to examine readmissions, please refer to the following publications:

Introduction to the HCUP State Inpatient Databases. Online. September 2011. U.S. Agency for Healthcare Research and Quality. Available at http://hcup-us.ahrq.gov/db/state/siddist/Introduction_to_SID.pdf. (Accessed July 12, 2012).

Overview of the HCUP Supplemental Files for Revisit Analyses. Available at http://www.hcup-us.ahrq.gov/toolssoftware/revisit/revisit.jsp. (Accessed July 12, 2012).

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AHRQ welcomes questions and comments from readers of this publication who are interested in obtaining more information about access, cost, use, financing, and quality of health care in the United States. We also invite you to tell us how you are using this Statistical Brief and other HCUP data and tools, and to share suggestions on how HCUP products might be enhanced to further meet your needs. Please e-mail us at hcup@ahrq.gov or send a letter to the address below:

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