Readmissions following Hospitalizations with *Clostridium difficile* Infections, 2009

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Introduction

*Clostridium difficile* is a common cause of health care associated infectious colitis\(^1\) with symptoms ranging from mild diarrhea to pseudomembranous colitis and toxic megacolon.\(^2\) *Clostridium difficile* infections (CDI) often occur as a complication of antibiotic therapy\(^3\) with certain populations, such as the elderly, at highest risk.\(^4\) Previous reports in this series described steady increases during the past decade; however, the number of CDI hospital stays leveled off during 2008–2010.\(^5,6,7\)

The problem of readmissions to the hospital is receiving increased attention\(^9,10,11\) although information on hospital readmissions following CDI is limited. One report examined CDI readmissions for a single county in California\(^8\) and tracked readmissions up to 12 weeks after discharge for CDI.

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**Highlights**

- Among patients with a principal or secondary diagnosis of CDI during hospitalization, 4.8 percent were readmitted within 30 days with CDI as a principal diagnosis, 12.8 percent were readmitted with any-listed CDI, and 29.1 percent were readmitted for any cause.
- Ninety-day readmission rates for CDI index stays were higher—6.8 percent had CDI as the principal diagnosis on readmission, 17.2 percent were readmitted within 90 days with any-listed CDI, and 44.8 percent were readmitted with any diagnosis.
- Thirty-day readmission rates with CDI were highest for patients covered by Medicare (14.1 percent) and lowest for uninsured patients (7.2 percent).
- Ninety-day all-cause readmission rates for CDI index stays were highest for patients covered by Medicaid (48.6 percent) and Medicare (46.8 percent).
- Overall, 41.5 percent of CDI index stays resulted in discharge to long term care, and readmission rates for these patients were higher than for patients overall. Most striking was the all-cause readmission rate for long term care patients—nearly half of these patients (49.0 percent) were readmitted to the hospital within 90 days.
- Among patients with a diagnosis of CDI on readmission, over a third had CDI as the principal diagnosis for both 30-day and 90-day readmissions. Infection-related diagnoses predominate—sepsisemia, pneumonia, and UTI. Other conditions on readmission reflect serious complications—CHF, complication of medical care, respiratory failure, aspiration pneumonitis, and renal failure.
This Statistical Brief presents data from the Healthcare Cost and Utilization Project (HCUP) on 30-day and 90-day CDI readmissions in U.S. hospitals during 2009. CDI index stays are defined as hospitalizations with any CDI diagnosis (principal or secondary) during January to November (for 30-day readmissions) or January to September (for 90-day readmissions). CDI hospital stays reported here include any discharge that is coded with a diagnosis of CDI, regardless of where the condition originated (in the hospital or in the community). Readmissions are tracked across the same or different hospitals within the 30-day or 90-day period within the same state. Readmission rates are examined for all patients and by age group, sex, and payer. In addition, principal diagnoses during readmissions are listed. Readmissions are also examined for the subgroup of patients discharged to long term care and nursing homes. Differences highlighted in the text are at least 10 percent between comparisons.

Findings

Among patients with a principal or secondary diagnosis of CDI during hospitalization, 4.8 percent were readmitted within 30 days with CDI as a principal diagnosis, 12.8 percent were readmitted with CDI as a principal or secondary diagnosis, and 29.1 percent were readmitted for any cause (table 1). Ninety-day readmission rates were higher—6.8 percent were readmitted with CDI as a principal diagnosis, 17.2 percent were readmitted with any-listed CDI, and 44.8 percent were readmitted for any cause. Costs per stay were 35-55 percent lower than the index hospital stays for all types of readmissions.

Table 1. Readmissions following hospital stays associated with CDI and cost per stay, 2009

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Cost per stay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Percentage readmitted)</td>
<td></td>
</tr>
<tr>
<td>Number of index stays with CDI (January to November)</td>
<td>280,700</td>
<td>$26,900</td>
</tr>
<tr>
<td>Percentage readmitted within 30 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With CDI as the principal diagnosis</td>
<td>4.8%</td>
<td>$11,800</td>
</tr>
<tr>
<td>With CDI in any diagnosis field*</td>
<td>12.8%</td>
<td>$17,700</td>
</tr>
<tr>
<td>With any diagnosis**</td>
<td>29.1%</td>
<td>$16,200</td>
</tr>
<tr>
<td>Number of index stays with CDI (January to September)</td>
<td>233,800</td>
<td>$26,800</td>
</tr>
<tr>
<td>Percentage readmitted within 90 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With CDI as the principal diagnosis</td>
<td>6.8%</td>
<td>$11,500</td>
</tr>
<tr>
<td>With CDI in any diagnosis field*</td>
<td>17.2%</td>
<td>$17,700</td>
</tr>
<tr>
<td>With any diagnosis**</td>
<td>44.8%</td>
<td>$15,800</td>
</tr>
</tbody>
</table>

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)

*CDI is the principal diagnosis or a secondary diagnosis in the readmission, i.e., all-listed CDI

** All-cause readmissions

Readmissions by age following hospital stays with CDI

Figure 1 illustrates readmission rates by age group. Thirty-day readmissions with CDI as a principal diagnosis ranged from 2.0 percent for the youngest age group to 5.5 percent for patients 65 and older. Thirty-day readmission rates for any-listed CDI ranged from 8.3 percent for pediatric cases to 14.2 percent for patients 65 and older. All-cause 30-day readmissions showed less variation across age groups, ranging from 26.5 percent to 29.6 percent.

Ninety-day readmissions were uniformly higher than 30-day readmissions across all age groups, with 40 percent or more in all age groups readmitted for any cause.

While both 30-day and 90-day readmission rates with a diagnosis of CDI were highest for patients older than 65 years, all-cause readmissions were similar for patients ages 45–64 and 65 plus.

Figure 1. Readmissions following hospital stays associated with CDI: 30-day and 90-day readmission rates by age, 2009

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, readmissions file based on the State Inpatient Databases, 2009
**Readmissions by sex following hospital stays with CDI**

Figure 2 illustrates that readmission rates for males and females were comparable for most types of readmissions (less than 7 percent differences between males and females for both 30- and 90-day all-cause readmissions for all-listed CDI and all-cause readmissions). For readmissions with CDI as the principal diagnoses, rates were 20–25 percent higher for females.

**Figure 2. Readmissions following hospital stays associated with CDI: 30-day and 90-day readmission rates by sex, 2009**

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, readmissions file based on the State Inpatient Databases, 2009
Readmissions by primary expected payer following hospital stays with CDI

Figure 3 illustrates readmission rates by payer and shows that the 30-day readmission rate with CDI as the principal diagnosis was about 50 percent higher for patients covered by Medicare (5.3 percent) than for all other payers (3.5–3.6 percent).

The 30-day readmission rate with CDI as any-listed diagnosis was lowest for uninsured patients (7.2 percent) and nearly twice as high for Medicare-covered patients (14.1 percent). Nearly 11 percent of Medicaid-covered patients and 9.4 percent of privately insured patients were readmitted with CDI within 30 days. Ninety-day readmission rates with CDI as a principal diagnosis and any-listed CDI showed a similar pattern.

However, all-cause readmission rates were two to three times higher than readmissions with CDI at both 30 and 90 days. Within 30 days following discharge with CDI, 32.7 of Medicaid-covered patients were readmitted to the hospital for any cause and within 90 days, 48.6 percent of patients covered by Medicaid were readmitted for any cause. These readmission rates were similar to those for Medicare. All-cause readmission rates for Medicare- and Medicaid-covered patients were 30–50 percent higher than for privately insured and uninsured patients at both 30 and 90 days.

Figure 3. Readmissions following hospital stays associated with CDI: 30-day and 90-day readmission rates by payer, 2009

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, readmissions file based on the State Inpatient Databases, 2009
Readmissions among patients discharged to long term care following hospital stays associated with CDI

Table 2 provides information on readmissions for the subset of patients discharged to long term care (LTC) after an index stay that involved CDI. Overall, 41.5 percent of index stays were discharged to long term care. For most types of readmissions, readmission rates for patients discharged to LTC were somewhat higher than for patients overall. For example, 14.0 percent of patients discharged to LTC were readmitted within 30 days with any-listed diagnosis of CDI, compared to 12.8 percent overall (see Table 1). However, readmission rates among patients discharged to LTC were lower for CDI as the principal diagnosis (e.g., 3.8 percent of LTC patients were readmitted for CDI as the principal diagnosis, compared to 4.8 percent overall [see Table 1]). Most striking was the all-cause readmission rate for long term care patients—nearly half (49.0 percent) were readmitted within 90 days.

Table 2. Readmissions following index hospital stays associated with CDI for patients discharged to long term care (LTC) after their index stay, 2009

<table>
<thead>
<tr>
<th>Number of index stays with CDI discharged to LTC (January to November)</th>
<th>N (Percentage readmitted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of CDI index stays discharged to LTC</td>
<td>41.5%</td>
</tr>
<tr>
<td>Readmitted within 30 days</td>
<td></td>
</tr>
<tr>
<td>With CDI as the principal diagnosis</td>
<td>3.8%</td>
</tr>
<tr>
<td>With CDI in any diagnosis field</td>
<td>14.0%</td>
</tr>
<tr>
<td>With any diagnosis</td>
<td>31.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of index stays with CDI discharged to LTC (January to September)</th>
<th>97,200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of CDI index stays discharged to LTC</td>
<td>41.6%</td>
</tr>
<tr>
<td>Readmitted within 90 days</td>
<td></td>
</tr>
<tr>
<td>With CDI as the principal diagnosis</td>
<td>5.9%</td>
</tr>
<tr>
<td>With CDI in any diagnosis field</td>
<td>19.7%</td>
</tr>
<tr>
<td>With any diagnosis</td>
<td>49.0%</td>
</tr>
</tbody>
</table>

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)
Reasons for readmissions
Table 3 provides information on the principal diagnoses for readmissions following an index stay that involved CDI. Among patients with a diagnosis of CDI on readmission, over a third of readmitted patients have a diagnosis of CDI as the principal diagnosis for both 30-day and 90-day readmissions. Other infection-related diagnoses predominate—sepsis, pneumonia, and UTI. Other conditions reflect serious complications or comorbidities—CHF, complication of medical care, respiratory failure, aspiration pneumonitis, and renal failure. A similar pattern was seen for patients discharged to long term care following their index stay (data not shown).

Table 3. Top 10 principal diagnoses for readmissions following a CDI index stay, 2009

<table>
<thead>
<tr>
<th>Principal diagnosis*</th>
<th>30-day readmissions</th>
<th>90-day readmissions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Readmission</td>
<td>All-cause</td>
</tr>
<tr>
<td></td>
<td>with CDI as any</td>
<td>readmission</td>
</tr>
<tr>
<td></td>
<td>diagnosis</td>
<td>following a stay</td>
</tr>
<tr>
<td></td>
<td>Percentage of total</td>
<td>Percentage of total</td>
</tr>
<tr>
<td>Clostridium difficile (ICD-9 code 008.45)</td>
<td>37.6</td>
<td>16.5</td>
</tr>
<tr>
<td>Septicemia (except in labor)</td>
<td>13.7</td>
<td>12.1</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>4.0</td>
<td>4.9</td>
</tr>
<tr>
<td>Complication of device, implant or graft</td>
<td>3.4</td>
<td>4.2</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>2.8</td>
<td>3.6</td>
</tr>
<tr>
<td>Urinary tract infections</td>
<td>2.0</td>
<td>3.1</td>
</tr>
<tr>
<td>Respiratory failure; insufficiency; arrest</td>
<td>1.7</td>
<td>2.2</td>
</tr>
<tr>
<td>Aspiration pneumonitis; food/vomit</td>
<td>1.7</td>
<td>--</td>
</tr>
<tr>
<td>Complications of surgical procedures or medical care</td>
<td>1.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Acute and unspecified renal failure</td>
<td>1.6</td>
<td>2.3</td>
</tr>
<tr>
<td>Fluid and electrolyte disorders</td>
<td>--</td>
<td>2.6</td>
</tr>
<tr>
<td>Percentage of all readmissions attributable to the top 10 principal diagnoses</td>
<td>70.1</td>
<td>54.1</td>
</tr>
</tbody>
</table>

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)

* Except for Clostridium difficile, all diagnoses are categorized using the Clinical Classification Software (CCS)
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 unweighted discharges.

Definitions

*Diagnoses, ICD-9-CM, and Clinical Classifications Software (CCS)*

The *principal diagnosis* is that condition established after study to be chiefly responsible for the patient’s admission to the hospital. *Secondary diagnoses* are concomitant conditions that coexist at the time of admission or that develop during the stay. For this study, all-listed diagnoses were used (principal and secondary diagnoses).

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.

CCS categorizes ICD-9-CM diagnoses into a manageable number of clinically meaningful categories. This "clinical grouper" makes it easier to quickly understand patterns of diagnoses. CCS categories identified as “Other” are typically not reported; these categories include miscellaneous, otherwise unclassifiable diagnoses that may be difficult to interpret as a group.

*Case definition*

The ICD-9-CM codes defining Clostridium difficile infections (CDI) include the following diagnosis code: 008.45.

*Readmission*

The 30-day (90-day) readmission rate is defined as the number of admissions for which there was at least one subsequent hospital admission within 30 (90) days divided by the total number of admissions between January and November 2009 (January and September 2009). That is, when a patient is discharged from the hospital, they are followed for 30 (90) 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 (90) 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 admissions for which there was more than one readmission in the 30 (90) day period, the data presented in this Statistical Brief reflect the characteristics of the first readmission.

Every qualifying hospital stay with the specified procedure 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 (January to September) observation period. In addition, 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. Admissions were disqualified from the analysis as index admissions if they could not be followed for 30 (90) days for one of the following

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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 (September to December) of 2009.

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). 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.

Mean cost per day is calculated as the mean cost per stay divided by the mean length of stay.

Payer
Payer is the expected primary payer for the hospital stay. To make coding uniform across all HCUP data sources, payer combines detailed categories into more general groups:

- Medicare: includes fee-for-service and managed care Medicare patients
- Medicaid: includes fee-for-service and managed care Medicaid patients. Patients covered by the State Children's Health Insurance Program (SCHIP) may be included here. Because most State data do not identify SCHIP patients specifically, it is not possible to present this information separately.
- Private Insurance: includes Blue Cross, commercial carriers, and private HMOs and PPOs
- Other: includes Worker's Compensation, TRICARE/CHAMPUS, CHAMPVA, Title V, and other government programs
- Uninsured: includes an insurance status of "self-pay" and "no charge."

When more than one payer is listed for a hospital discharge, the first-listed payer is used.

Discharge status
Discharge status indicates the disposition of the patient at discharge from the hospital and includes the following six categories: routine (to home); transfer to another short-term hospital; other transfers (including skilled nursing facility, intermediate care, and another type of facility such as a nursing home); home health care; against medical advice (AMA); or died in the hospital.

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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  
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 Center for Health Information and Analysis  
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  
Nevada Department of Health and Human Services  
New Hampshire Department of Health & Human Services  
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 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
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/.


Suggested Citation


*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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