



Adult, Nonmaternal Inpatient Stays Related to *Clostridioides difficile*:
National Trends, 2011-2016 and 2019

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OVERVIEW

Health care-associated infections are a threat to patient safety and have become the most common complication of modern health care. In 2009, the Department of Health and Human Services (HHS) identified key actions needed to achieve and sustain progress in protecting patients from the transmission of serious and, in some cases, deadly infections in the *National Action Plan to Prevent Health Care-Associated Infections: Road Map to Elimination*.¹ The response to this call to action has been seen at the Federal, State, and local levels.

This report, funded by the Agency for Healthcare Research and Quality (AHRQ), focuses on the burden to hospitals of one type of health care-associated infection— *Clostridioides difficile* (*C. diff*). *C. diff* may develop during the process of a patient’s treatment for medical or surgical conditions in health care settings, including hospitals, clinics, nursing homes, and other health facilities.^{2,3} *C. diff* may also be acquired in the community.^{4,5} The original report ([Clostridium Difficile Hospitalizations: National and Regional Trends, 2011-2015](#)) is available on the HCUP-US website; this reposting of the reporting includes national estimates for 2016 and 2019. This report examines the changes in rates of hospitalizations related to *C. diff*, including those in which *C. diff* is not present on admission (hospital-onset) and those present on admission (community-acquired). Estimates from 2016 and 2019 are compared to estimates from Q1-Q3 2015.⁶

C. diff includes a broad spectrum of illnesses, ranging from uncomplicated diarrhea in its mildest form to its most severe manifestation of fulminant sepsis. *C. diff* is recognized as a main cause of diarrhea in health care facilities, where it has been associated with excess lengths of stay and substantial increases in health care costs.⁷ *C. diff* transmission occurs primarily via the hands of health care personnel or from a contaminated environment. A well-established risk factor for *C. diff* is previous antimicrobial therapy, which may suppress the normal flora of the colon and allow growth of *C. diff* after exposure occurs. Treatment of severe cases may require a colectomy and may result in death.

¹ Details of the HHS Action Plan are available at www.hhs.gov/ash/initiatives/hai/actionplan/. Accessed December 13, 2017.

² Centers for Disease Control and Prevention. CDC Features. Vital Signs: Stopping *C. difficile* Infections. March 2012. www.cdc.gov/vitalsigns/hai/stoppingcdifficile/. Accessed December 13, 2017.

³ CENTERS FOR DISEASE CONTROL AND PREVENTION. MORBIDITY AND MORTALITY WEEKLY REPORT (MMWR). VITAL SIGNS: PREVENTING *CLOSTRIDIUM DIFFICILE* INFECTIONS. MARCH 9, 2012;61(09):157-162. www.cdc.gov/mmwr/preview/mmwrhtml/mm6109a3.htm?s_cid=mm6109a3_w. Accessed December 13, 2017.

⁴ CENTERS FOR DISEASE CONTROL AND PREVENTION. MORBIDITY AND MORTALITY WEEKLY REPORT (MMWR). SURVEILLANCE FOR COMMUNITY-ASSOCIATED *CLOSTRIDIUM DIFFICILE* --- CONNECTICUT, 2006, APRIL 4, 2008;57(13);340-3. www.cdc.gov/mmwr/preview/mmwrhtml/mm5713a3.htm. Accessed December 13, 2017.

⁵ Kuntz JL, Chrischilles EA, Pendergast JF, Herwaldt LA, Polgreen PM. Incidence of and risk factors for community-associated *Clostridium difficile* infection: a nested case-control study. *BMC Infect Dis*. 2011 Jul 15;11:194.

⁶ Trending from ICD-9-CM to ICD-10-CM is typically not recommended because of the intrinsic differences in the two coding systems. In this case, there is only one diagnosis code under ICD-9-CM and two ICD-10-CM diagnosis codes that are similar to the ICD-9-CM diagnosis except for the identification of recurrence.

⁷ Dubberke ER, Reske KA, Olsen MA, McDonald LC, Fraser VJ. Short- and long-term attributable costs of *Clostridium difficile*-associated disease in nonsurgical inpatients. *Clin Infect Dis*. 2008 Feb 15;46(4):497-504.

Timely information on the burden of *C. diff* cases in the inpatient setting provides analysts and policymakers with baseline information and helps illustrate the need for quality improvement efforts. Therefore, information about national trends in the prevalence of adult inpatient discharges with *C. diff* is presented in this report.

METHODS

Longitudinal inpatient discharge data from the Healthcare Cost and Utilization Project (HCUP) sponsored by AHRQ were used to provide quarterly estimates of *C. diff* hospitalization rates from 2011 through 2019. HCUP includes the largest collection of longitudinal hospital care data in the United States, with all-payer, encounter-level information beginning in 1988. The HCUP State Inpatient Databases (SID) in 2019 encompass about 97 percent of all U.S. community hospital discharges, made possible by the data collection efforts of State data organizations, hospital associations, private data organizations, and the Federal government. The HCUP Partner organizations are listed in Appendix A. Background on the SID is provided in Appendix B.

For this report, *C. diff* hospitalizations discharged prior to October 2015 were identified by the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis code of intestinal infections due to *Clostridium difficile* (008.45), which were reported as either the principal or secondary diagnosis. An evaluation of surveillance for *C. diff* in 2003 found high sensitivity (78%) and specificity (99.7%) when using ICD-9-CM codes.⁸ This study was based on one hospital. Coding practices will vary across hospitals and States. Starting in October 2015, the United States transitioned to reporting diagnoses using the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM). From October 2015 through September 2017, the ICD-10-CM diagnosis code for Enterocolitis due to *Clostridioides difficile* was A04.7. Starting in October 2017, there were two ICD-10-CM diagnosis codes that differentiated on recurrence: A04.71 for Enterocolitis due to *Clostridioides difficile*, recurrent, and A04.72 for Enterocolitis due to *Clostridioides difficile*, not specified as recurrent. These ICD-10-CM codes could be reported as either the principal or secondary diagnosis to identify *C. diff* hospitalizations.

The annual rates were calculated as the number of *C. diff* hospitalizations per 1,000 adult, nonmaternal discharges treated in community, nonrehabilitation hospitals in the year. *C. diff* cases that resolved without an inpatient stay are not captured in the trends. It should be noted that the origin of the infection may not be the inpatient hospital. It is possible that the *C. diff* infection originated in another type of health care setting, such as a nursing home, or in the community prior to the hospital admission. In most of the SID, there was a data element that indicated whether the *C. diff* diagnosis was present on admission, rather than acquired during the hospital stay. This allowed the rate of *C. diff* hospitalizations to be reported for all stays related to *C. diff* and also by whether the *C. diff* diagnosis was present on admission or not. Additional details about the methods used for this report are contained in Appendix C.

⁸ Dubberke ER, Reske KA, McDonald LC, Fraser VJ. ICD-9 codes and surveillance for *Clostridium difficile*-associated disease. *Emerg Infect Dis*. 2006 Oct;12(10):1576-9.

RESULTS

The following tables show national trends in adult, nonmaternal inpatient stays related to *C. diff*. From 2015 to 2016, there was a reduction of 4.2 percent in the rate of any diagnosis of *C. Diff* per 1,000 adult, nonmaternal discharges (Table 1). From 2015 to 2016 and 2019, there was a reduction of 28.6 percent in the rate.

Table 1. Rate of Adult, Nonmaternal Inpatient Stays with Any Diagnosis of *Clostridioides difficile*, 2011-2016 and 2019

Year	Rate of Any Diagnosis of <i>C. Diff</i> per 1,000 Adult, Nonmaternal discharges	95% confidence interval
2011	13.0	(12.7, 13.3)
2012	13.6	(13.3, 13.9)
2013	13.8	(13.6, 14.1)
2014	14.0	(13.8, 14.2)
2015 Q1-Q3	14.2	(14.0, 14.5)
2016	13.6	(13.4, 13.9)
2019	10.2	(9.9, 10.4)

Note: Additional analyses of national estimates overall (not shown) for 2017 and 2018 suggest that hospitalizations for *C. diff* declined each year.

Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID) nationally weighted analysis file, 2011–2016 and 2019. ICD-9-CM Diagnoses from 2011 Q1–2015 Q3 and ICD-10-CM Diagnoses from 2016 and 2019

From 2015 to 2016, there was a reduction of 3.4 percent in the rate of any diagnosis of *C. Diff* reported as present on admission per 1,000 adult, nonmaternal discharges (Table 2). From 2015 to 2016 and 2019, there was a reduction of 26.5 percent in the rate.

Table 2. Rate of Adult, Nonmaternal Inpatient Stays with Any Diagnosis of *Clostridioides difficile* Reported as Present on Admission to the Hospital, 2011-2016 and 2019

Year	Rate of Any Diagnosis of <i>C. Diff</i> Reported as Present on Admission per 1,000 Adult, Nonmaternal discharges	95% confidence interval
2011	9.8	(9.6, 10.1)
2012	10.4	(10.2, 10.6)
2013	10.6	(10.4, 10.8)
2014	10.9	(10.7, 11.0)
2015 Q1-Q3	11.3	(11.1, 11.5)
2016	10.9	(10.7, 11.1)
2019	8.3	(8.1, 8.5)

Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID) nationally weighted analysis file, 2011–2016 and 2019. ICD-9-CM Diagnoses from 2011 Q1–2015 Q3 and ICD-10-CM Diagnoses from 2016 and 2019

From 2015 to 2016, there was a reduction of 8.9 percent in the rate of any diagnosis of *C. Diff* not reported as present on admission per 1,000 adult, nonmaternal discharges (Table 3). From 2015 to 2016 and 2019, there was a reduction of 38.2 percent in the rate.

Table 3. Rate of Adult, Nonmaternal Inpatient Stays with Any Diagnosis of *Clostridioides difficile* Not Reported as Present on Admission to the Hospital, 2011-2016 and 2019

Year	Rate of Any Diagnosis of <i>C. Diff</i> Not Reported as Present on Admission per 1,000 Adult, Nonmaternal discharges	95% confidence interval
2011	3.2	(3.0, 3.3)
2012	3.2	(3.1, 3.3)
2013	3.2	(3.1, 3.3)
2014	3.2	(3.1, 3.2)
2015 Q1-Q3	3.0	(2.9, 3.1)
2016	2.7	(2.6, 2.8)
2019	1.9	(1.8, 1.9)

Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID) nationally weighted analysis file, 2011–2016 and 2019. ICD-9-CM Diagnoses from 2011 Q1–2015 Q3 and ICD-10-CM Diagnoses from 2016 and 2019

APPENDIX A. HEALTHCARE COST AND UTILIZATION PROJECT (HCUP) PARTNER ORGANIZATIONS

Alaska Department of Health and Social Services
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
Delaware Division of Public Health
District of Columbia Hospital Association
Florida Agency for Health Care Administration
Georgia Hospital Association
Hawaii Lailima Data Alliance
Hawaii University of Hawaii at Hilo
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
Maine Health Data Organization
Maryland Health Services Cost Review Commission
Massachusetts Center for Health Information and Analysis
Michigan Health & Hospital Association
Minnesota Hospital Association (provides data for Minnesota and North Dakota)
Mississippi State Department of Health
Missouri Hospital Industry Data Institute
Montana Hospital Association
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
North Dakota (data provided by the Minnesota Hospital Association)
Ohio Hospital Association
Oklahoma State Department of Health
Oregon Association of Hospitals and Health Systems
Oregon Office of Health Analytics
Pennsylvania Health Care Cost Containment Council
Rhode Island Department of Health
South Carolina Revenue and Fiscal Affairs Office
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 Department of Health and Human Resources, West Virginia Health Care Authority
Wisconsin Department of Health Services
Wyoming Hospital Association

APPENDIX B. HEALTHCARE COST AND UTILIZATION PROJECT (HCUP) STATE INPATIENT DATABASES (SID)

The Healthcare Cost and Utilization Project (HCUP) is a family of health care databases and related software tools and products developed through a Federal-State-Industry partnership and sponsored by the Agency for Healthcare Research and Quality (AHRQ). HCUP databases bring together the data collection efforts of State data organizations, hospital associations, private data organizations, and the Federal government to create a national information resource of encounter-level health care data. HCUP includes the largest collection of longitudinal hospital care data in the United States, with all-payer, encounter-level information beginning in 1988. These databases enable research on a broad range of health policy issues, including cost and quality of health services, medical practice patterns, access to health care programs, and outcomes of treatments at the national, State, and local market levels.

The HCUP State Inpatient Databases (SID) contain the universe of the inpatient discharge abstracts from participating States that are translated into a uniform format to facilitate multistate comparisons and analyses. Together, the SID encompass over 95 percent of all U.S. hospital discharges.

The SID contain clinical and resource-use information that is included in a typical discharge abstract, with safeguards to protect the privacy of individual patients, physicians, and hospitals. The SID contain more than 100 clinical and nonclinical variables, such as:

- Principal and secondary diagnoses and procedures
- Admission and discharge status
- Patient demographics characteristics (e.g., sex, age, and, for some States, race/ethnicity)
- Expected payment source
- Total charges
- Length of stay.

More information is available on the HCUP User Support website (www.hcup-us.ahrq.gov).

APPENDIX C. METHODS FOR CALCULATING NATIONAL ESTIMATES

This section describes the methods employed to calculate national, annual trends for the rates of *C. diff* hospitalizations per 1,000 adult, nonmaternal hospitalizations using the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID).

Discharges were limited to those from hospitals that were open during any part of each calendar year and were designated as community hospitals by the American Hospital Association (AHA) Annual Survey of Hospitals, excluding rehabilitation hospitals. The definition of a community hospital was that used by the AHA: "all nonfederal short-term general and other specialty hospitals, whose facilities and services are available to the public." The population at risk included only adult, nonmaternal discharges aged 18 years and older. Nonmaternal is defined as not in the Major Diagnostic Category for pregnancy, childbirth, and the puerperium (MDC not equal to 14).

The analysis was limited to SID that included data elements indicating whether the principal and secondary diagnoses were present on admission (POA) rather than acquired during the hospital stay. Because the reporting of POA can vary across hospitals within and across States, the data were edited for consistent coding of POA using a scheme developed by HCUP.⁹ There were two discharge-level and three hospital-level edit checks:

- Discharge was missing POA on the principal diagnosis.
- Discharge was missing POA on all secondary diagnoses.
- Hospital reported all diagnoses as present on admission on all discharges.
- Hospital reported POA only on Medicare discharges.
- Hospital had 15 percent or more of total discharges in the year missing POA on all diagnoses.

Discharges and hospitals failing any of the above edit checks were excluded from the analysis. All data from the SID were excluded if the overall failure rate for the POA edits was greater than 10 percent. Table C.1 lists the number of SID used for each data year. National weights were developed within stratum defined by five hospital characteristics (region, teaching status, size based on the number of beds, urban-rural location, and control) using the remaining SID discharges after POA edit checks and counts of total inpatient discharges from the AHA Annual Survey.

⁹ Barrett ML, Owens PL, Bolhack J, Sheng M. Examination of the Coding of Present-on-Admission Indicators in Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID). 2015. HCUP Methods Series Report #2015-06 ONLINE. September 1, 2015. U.S. Agency for Healthcare Research and Quality. Available: <http://www.hcup-us.ahrq.gov/reports/methods/methods.jsp>.

Table C.1. Number of HCUP State Inpatient Databases (SID) Used Each Year to Create for National Estimates

Data Year	Total Number of HCUP Partners	Number of SID with POA data elements	Number of SID Used for Weighting to National Estimates (Less than 10 Percent of SID Discharges Failed POA Edit Checks)
2011	47	36	28
2012	47	37	31
2013	48	38	33
2014	48	41	37
2015	48	43	39
2016	49	45	41
2019	49*	43	40

Abbreviations: HCUP, Healthcare Cost and Utilization Project; POA, Present on Admission; SID, State Inpatient Databases

*The State Inpatient Databases for 2019 from Missouri, Oklahoma, New Hampshire, and Washington were unavailable when this report was created.