CLOSTRIDIUM DIFFICILE HOSPITALIZATIONS 2011-2015

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INTRODUCTION

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.

The present report, funded by the Agency for Healthcare Research and Quality (AHRQ), focuses on the burden to hospitals of one type of healthcare-associated infection—*Clostridium difficile* infection (CDI). CDI 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] CDI also may be acquired in the community.[4,5]

CDI includes a broad spectrum of illnesses, ranging from uncomplicated diarrhea in its mildest form to its most severe manifestation of fulminant sepsis. CDI 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.[6] CDI transmission occurs primarily via the hands of health care personnel or from a contaminated environment. A well-established risk factor for CDI is previous antimicrobial therapy, which may suppress the normal flora of the colon and allow growth of CDI after exposure occurs. Treatment of severe cases may require a colectomy and may result in death.

Timely information on the burden of CDI cases in the inpatient setting provides analysts and policymakers with baseline information and helps illustrate the need for quality

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[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] 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.

improvement efforts. Therefore, information about national and regional trends in the prevalence of adult inpatient discharges with CDI is presented in this report.

Longitudinal inpatient discharge data from the Healthcare Cost and Utilization Project (HCUP) sponsored by AHRQ were used to provide quarterly and annual estimates of CDI hospitalization rates from 2011 through 2015. 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 2015 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. This report uses the HCUP SID from 2011 through 2015 from 42 States and the District of Columbia. The list of Partner organizations that contribute to HCUP databases is available in Appendix I.

For this report, *C. difficile* 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 CDI in 2003 found high sensitivity (78%) and specificity (99.7%) when using ICD-9-CM codes.[7] This study was based on one hospital. Coding practices will vary across hospitals and States. In the fourth quarter of calendar year 2015 (October–December), the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) diagnosis code of intestinal infections due to *Clostridium difficile* (A047), reported as either the principal or secondary diagnosis was used to identify *C. difficile* hospitalizations.

The quarterly rates were calculated as the number of *C. difficile* hospitalizations for adults per 1,000 adult, nonmaternal discharges treated in community, nonrehabilitation hospitals in the discharge quarter. CDI 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 CDI infection originated in another type of health care setting, such as a nursing home, or in the community prior to the hospital admission. The SID used for this analysis included a data element that indicated whether the CDI diagnosis was present on admission rather than acquired during the hospital stay. This allowed the rate of *C. difficile* hospitalizations to be reported for all stays related to CDI and also by whether the CDI diagnosis was present on admission or not. Additional details about the methods used for this report are contained in Appendix II.

Results are presented for the nation and four Census regions. Trend graphs are presented in the body of the report with the rate of *C. difficile* hospitalizations per 1,000 discharges for the years 2011 through 2015 surrounded by a band representing the 95

[7] 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.

percent confidence interval. The actual rates (rounded to one decimal place) are listed in Appendices III.

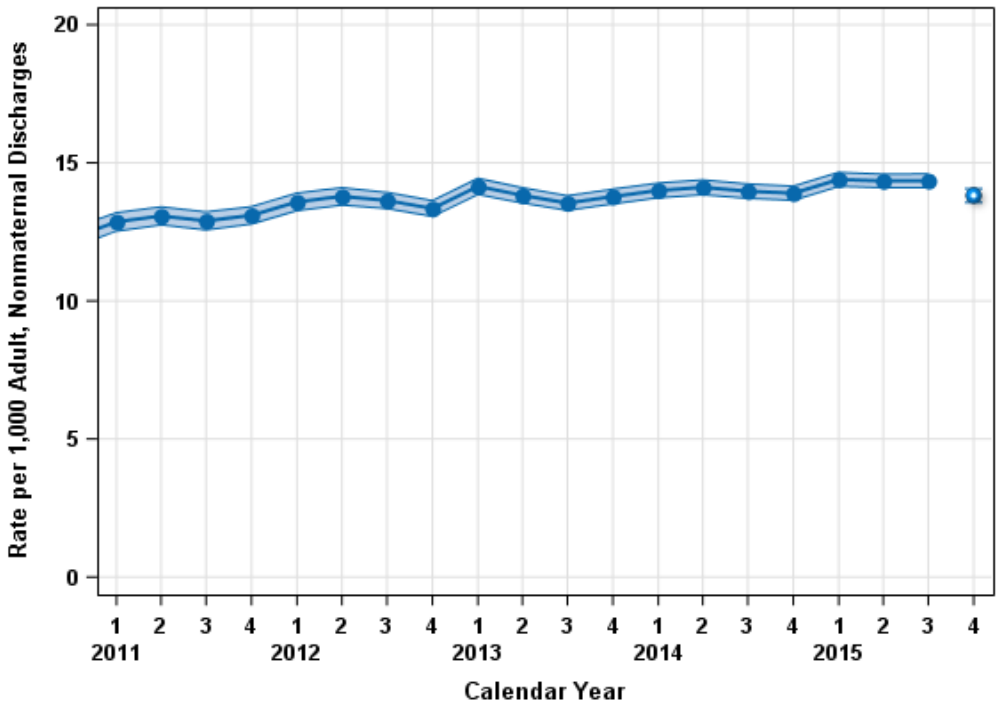
GENERAL TRENDS

National and regional trends showed variation in the rate of CDI stays per 1,000 adult, nonmaternal discharges from 2011 through 2015. The national annual rate of all CDI stays per 1,000 adult, nonmaternal discharges ranged from 13.0 in 2011 to 14.2 in 2015 (an increase of 9.2 percent). When the CDI diagnosis was present on admission, there was an increase of 11.2 percent in the national annual rate of CDI stays from 2011 through 2015. In contrast, there was a decrease of 9.4 percent in the national annual rate of CDI stays when the CDI diagnosis was acquired during the hospitalization. Although this report showed an increase in the overall rate of *C. difficile* hospitalizations, it cannot be determined whether this reflected an increase in unique cases. That distinction is beyond the limits of the data used.

In the Northeast region, the annual rate of all CDI stays was about 14.5 stays per 1,000 adult, nonmaternal discharges from 2011 through 2015, with some quarterly variation. The annual rates of all CDI stays in the other regions in 2011 were lower than the Northeast (Midwest, 13.8; South, 11.5; West, 13.3), but the annual rates in these regions increased by at least 5 percent from 2011 through 2015 (Midwest, 5.1 percent; South, 19.1 percent; West, 13.5 percent). The annual rate in the Northeast decreased by 2.1 percent from 2011 to 2015. In addition, the annual rates when the CDI diagnosis was present on admission increased by more than 9 percent in all regions except the Northeast, which decreased by 5.6 percent. All regions showed a decrease in the annual rates from 2011 through 2015 when the CDI diagnosis was acquired during the hospitalization (Northeast, 16.2 percent; Midwest, 6.3 percent; South, 3.4 percent; West, 3.3 percent).

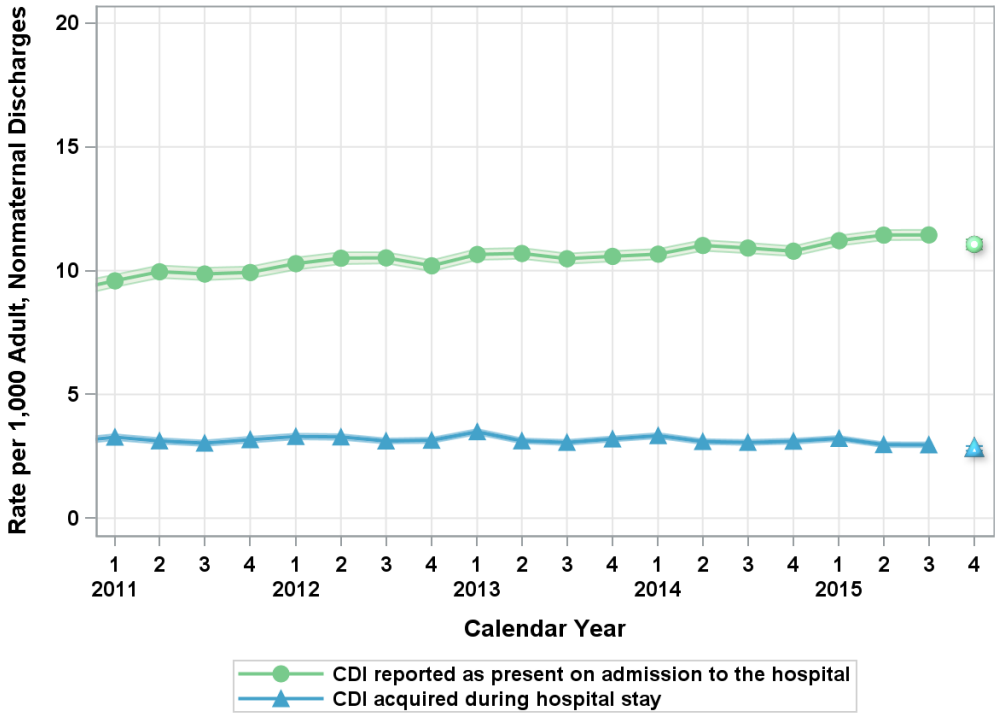
NATIONAL TRENDS

Rates for All CDI Stays



For 2011-2015Q3, CDI is identified using an ICD-9-CM code. In 2015Q4, CDI is identified using an ICD-10-CM code.

Rates for CDI Stays by Diagnosis Present on Admission



For 2011-2015Q3, CDI is identified using an ICD-9-CM code. In 2015Q4, CDI is identified using an ICD-10-CM code.

TRENDS BY CENSUS REGION

In 2011, the annual rates of *all CDI stays* per 1,000 adult, nonmaternal discharges ranged from 11.5 in the South to 14.5 in the Northeast. In 2015, the lowest rate was in the South (13.7), but the highest rate was in the West (15.1).

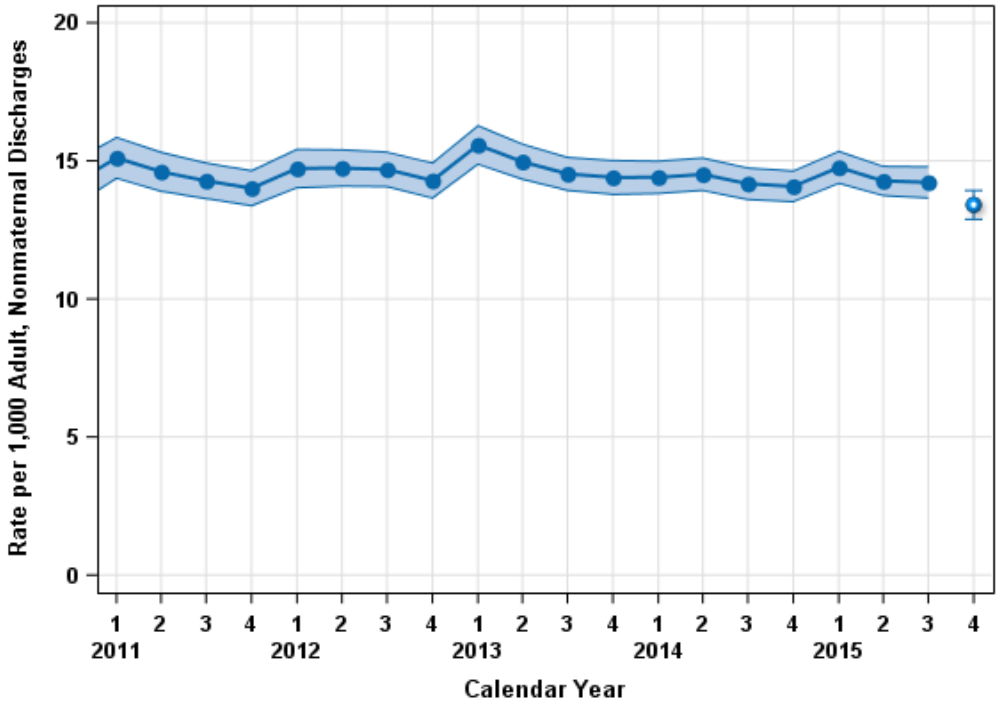
When the CDI diagnosis was present on admission, the 2011 annual rates ranged from 8.7 in the South to 10.8 in the Northeast. In 2015, the lowest rate was in the Northeast (10.2) and the highest rate was in the West (12.1).

When the CDI diagnosis was acquired during the hospitalization, the 2011 annual rates ranged from 2.9 in the South to 3.7 in the Northeast. In 2015, the lowest rate was in the South (2.8) and the highest rate was in the Northeast (3.1).

The following figures show the quarterly rates of CDI stays per 1,000 adult, nonmaternal discharges for the years 2011 through 2015 by Census region.

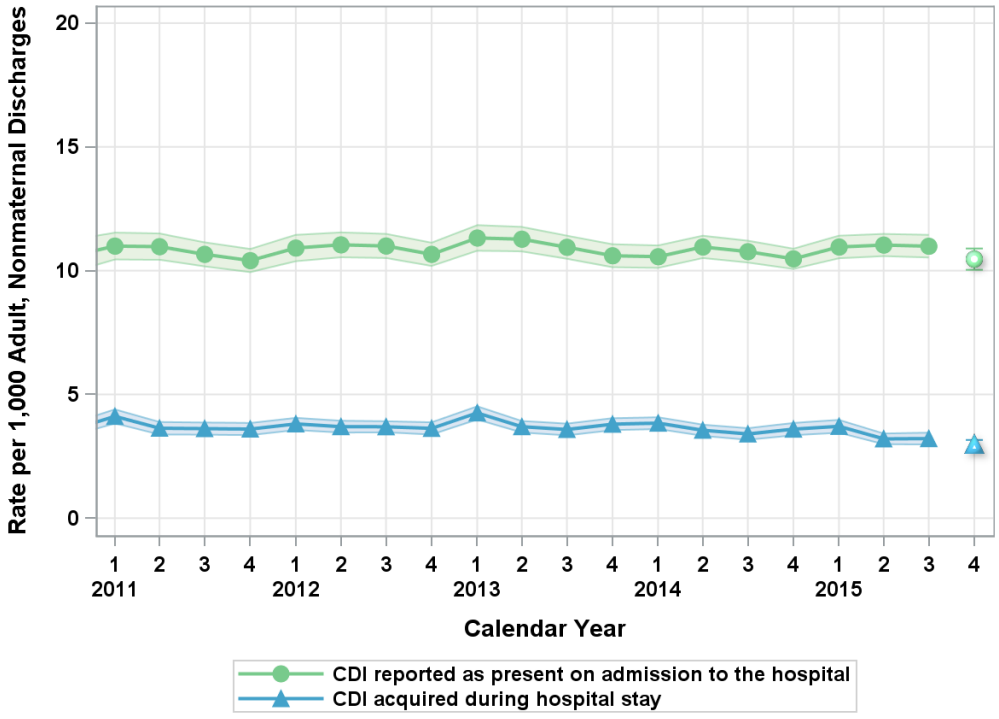
Northeast Region

Rates for All CDI Stays



For 2011-2015Q3, CDI is identified using an ICD-9-CM code. In 2015Q4, CDI is identified using an ICD-10-CM code.

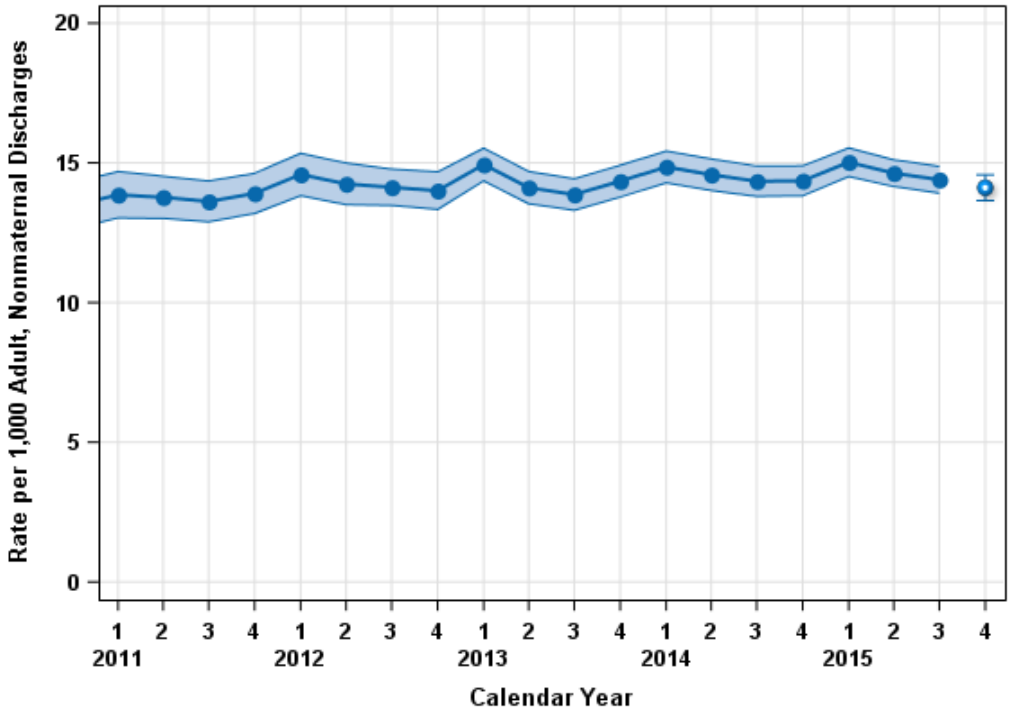
Rates for CDI Stays by Diagnosis Present on Admission



For 2011-2015Q3, CDI is identified using an ICD-9-CM code. In 2015Q4, CDI is identified using an ICD-10-CM code.

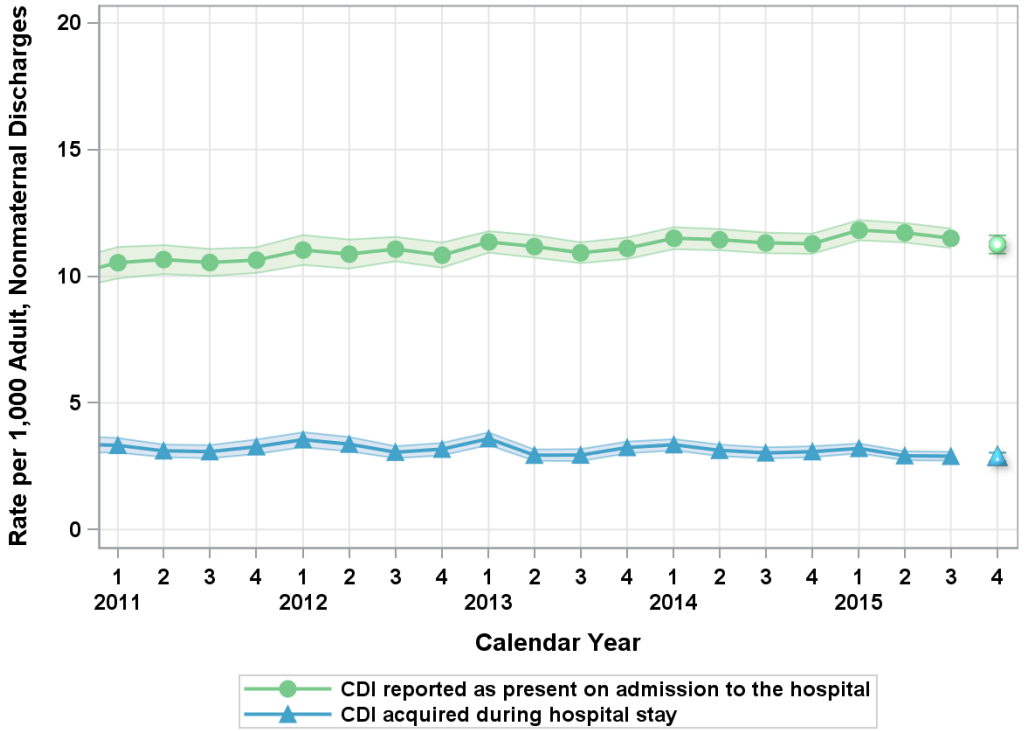
Midwest Region

Rates for All CDI Stays



For 2011-2015Q3, CDI is identified using an ICD-9-CM code. In 2015Q4, CDI is identified using an ICD-10-CM code.

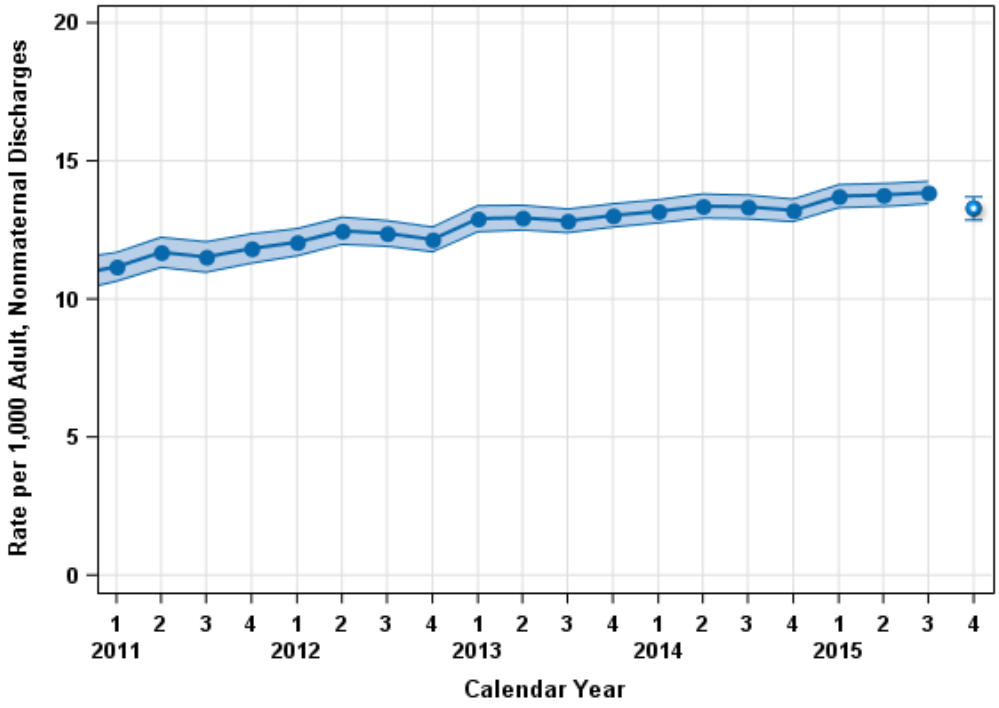
Rates for CDI Stays by Diagnosis Present on Admission



For 2011-2015Q3, CDI is identified using an ICD-9-CM code. In 2015Q4, CDI is identified using an ICD-10-CM code.

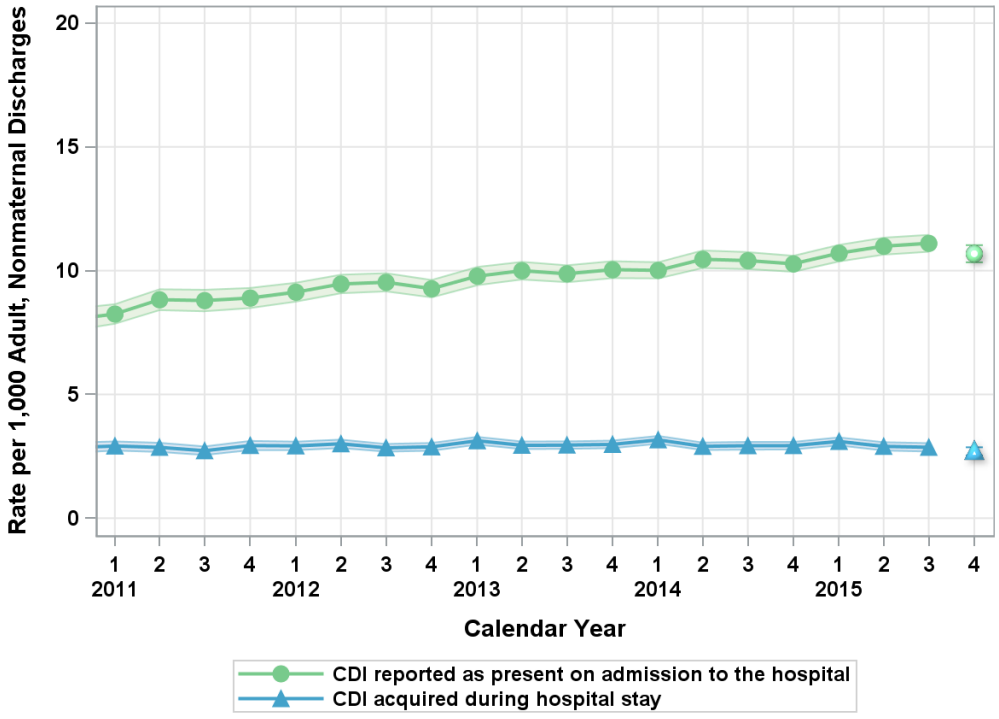
Southern Region

Rates for All CDI Stays



For 2011-2015Q3, CDI is identified using an ICD-9-CM code. In 2015Q4, CDI is identified using an ICD-10-CM code.

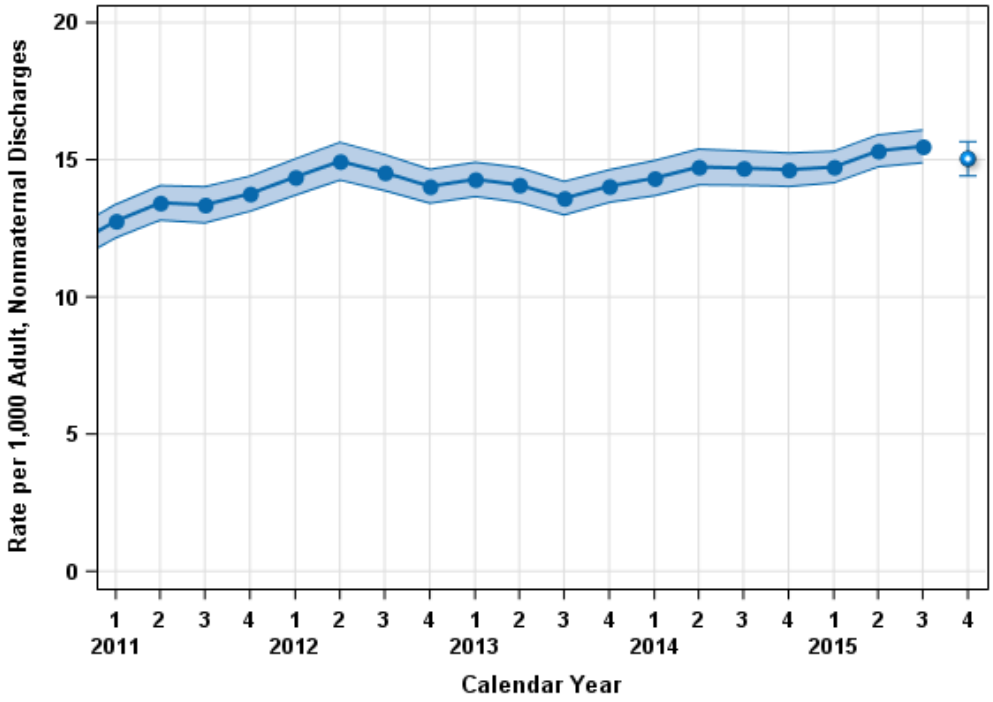
Rates for CDI Stays by Diagnosis Present on Admission



For 2011-2015Q3, CDI is identified using an ICD-9-CM code. In 2015Q4, CDI is identified using an ICD-10-CM code.

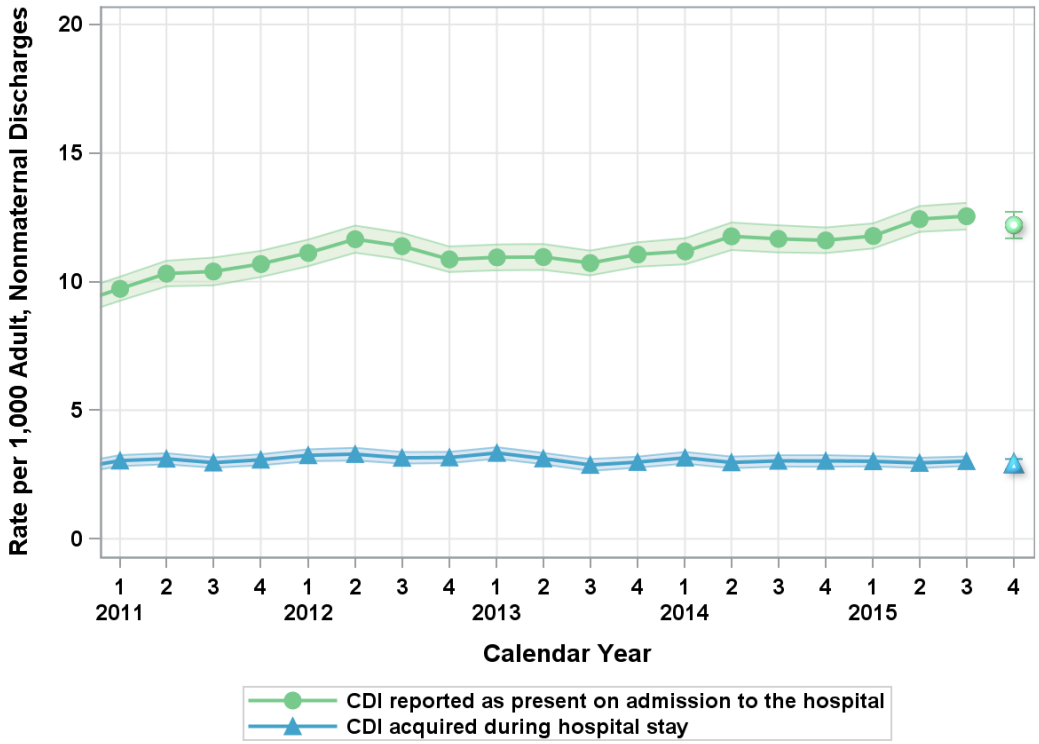
Western Region

Rates for All CDI Stays



For 2011-2015Q3, CDI is identified using an ICD-9-CM code. In 2015Q4, CDI is identified using an ICD-10-CM code.

Rates for CDI Stays by Diagnosis Present on Admission



For 2011-2015Q3, CDI is identified using an ICD-9-CM code. In 2015Q4, CDI is identified using an ICD-10-CM code.

APPENDIX I: HCUP PARTNERS

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

District of Columbia 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

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 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 II: METHODS

This section describes the methods employed to calculate national and regional quarterly trends for the rates of *C. difficile* hospitalizations per 1,000 adult, nonmaternal discharges using the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) from 2011 through 2015.

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. The AHA defines a community hospital as "all nonfederal short-term general and special hospitals, including special childrens' hospitals, whose facilities and services are available to the public."[8] Any community hospitals that the AHA identified as also being rehabilitation hospitals were excluded.

The population at risk included adult, nonmaternal discharges aged 18 years and older. Prior to October 2015, *C. difficile* hospitalizations discharged 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), reported as either the principal or secondary diagnosis. In the fourth quarter of calendar year 2015 (October–December), the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) diagnosis code of intestinal infections due to *Clostridium difficile* (A047), reported as either the principal or secondary diagnosis, was used to identify *C. difficile* hospitalizations. Transfers were excluded from the CDI counts and the population at risk.

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. There were 43 SID that included the POA data elements in 2015. 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.

[8] American Hospital Association. Glossary. https://www.ahadataviewer.com/glossary/

[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.

Discharges and hospitals failing any of the above edit checks were excluded from the analysis. All remaining discharges were used to develop the national and regional rates. 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.

APPENDIX III: DATA TABLES FOR ANNUAL RATES OF CDI STAYS PER 1,000 ADULT, NONMATERNAL DISCHARGES

Year	All CDI Stays		CDI Reported as Present on Admission		CDI Acquired During Hospital Stay	
	CDI rate per 1,000 discharges	95% confidence interval	CDI rate per 1,000 discharges	95% confidence interval	CDI rate per 1,000 discharges	95% confidence interval
Total U.S.						
2011	13.0	(12.7, 13.3)	9.8	(9.6, 10.1)	3.2	(3.0, 3.3)
2012	13.6	(13.3, 13.9)	10.4	(10.2, 10.6)	3.2	(3.1, 3.3)
2013	13.8	(13.6, 14.1)	10.6	(10.4, 10.8)	3.2	(3.1, 3.3)
2014	14.0	(13.8, 14.2)	10.9	(10.7, 11.0)	3.2	(3.1, 3.2)
2015	14.2	(14.0, 14.5)	11.3	(11.1, 11.5)	3.0	(2.9, 3.1)
Census Region: Northeast						
2011	14.5	(13.9, 15.2)	10.8	(10.3, 11.3)	3.7	(3.5, 4.0)
2012	14.6	(14.0, 15.2)	10.9	(10.5, 11.4)	3.7	(3.5, 3.9)
2013	14.9	(14.3, 15.5)	11.1	(10.6, 11.5)	3.8	(3.6, 4.1)
2014	14.3	(13.8, 14.9)	10.7	(10.3, 11.1)	3.6	(3.4, 3.8)
2015	14.2	(13.7, 14.7)	10.9	(10.5, 11.3)	3.3	(3.1, 3.5)
Census Region: Midwest						
2011	13.8	(13.1, 14.5)	10.6	(10.1, 11.1)	3.2	(3.0, 3.4)
2012	14.2	(13.6, 14.9)	11.0	(10.5, 11.4)	3.3	(3.1, 3.5)
2013	14.3	(13.8, 14.8)	11.1	(10.8, 11.5)	3.2	(3.0, 3.4)
2014	14.5	(14.0, 15.0)	11.4	(11.0, 11.8)	3.1	(2.9, 3.3)
2015	14.5	(14.1, 15.0)	11.6	(11.2, 11.9)	3.0	(2.8, 3.1)
Census Region: South						
2011	11.5	(11.0, 12.0)	8.7	(8.3, 9.1)	2.9	(2.7, 3.0)
2012	12.3	(11.8, 12.7)	9.3	(9.0, 9.7)	2.9	(2.8, 3.1)
2013	12.9	(12.5, 13.3)	9.9	(9.6, 10.2)	3.0	(2.9, 3.1)
2014	13.3	(12.9, 13.7)	10.3	(10.0, 10.6)	3.0	(2.8, 3.1)
2015	13.7	(13.3, 14.0)	10.9	(10.6, 11.2)	2.9	(2.7, 3.0)
Census Region: West						
2011	13.3	(12.7, 13.9)	10.3	(9.8, 10.7)	3.0	(2.9, 3.2)
2012	14.5	(13.9, 15.1)	11.3	(10.8, 11.7)	3.2	(3.0, 3.4)
2013	14.0	(13.4, 14.6)	10.9	(10.5, 11.4)	3.1	(2.9, 3.3)
2014	14.6	(14.0, 15.2)	11.6	(11.1, 12.0)	3.0	(2.8, 3.2)
2015	15.1	(14.6, 15.7)	12.2	(11.8, 12.7)	3.0	(2.8, 3.1)

Abbreviation: CDI, *Clostridium difficile* infection.

Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID), 2011–2015, weighted to provide national and regional estimates.