



H·CUP
HEALTHCARE COST AND UTILIZATION PROJECT

CLOSTRIDIUM DIFFICILE HOSPITALIZATIONS
2010-2014

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INTRODUCTION

Healthcare-associated infections are a threat to patient safety and have become a common complication of modern health care with 1 in 25 inpatients having an infection related to hospital care.¹ 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 improvement efforts. Therefore, information about national and regional trends in the prevalence of adult inpatient discharges with CDI is presented in this report.

¹ Details of the HHS Action Plan are available at the Office of Disease Prevention and Health Promotion. Overview of Health Care-Associated Infections. Last updated October 26, 2016. <http://www.hhs.gov/ash/initiatives/hai/actionplan/>. Accessed August 25, 2016.

² Centers for Disease Control and Prevention. Vital Signs: Stopping *C. difficile* Infections. CDC Features. March 2012. <http://www.cdc.gov/vitalsigns/hai/stoppingcdifficile/>. Accessed August 25, 2016.

³ Centers for Disease Control and Prevention. Vital signs: preventing *Clostridium difficile* infections. Morbidity and Mortality Weekly Report. 2012 March 9;61(09):157-62.

⁴ Centers for Disease Control and Prevention. Surveillance for community-associated *Clostridium difficile*—Connecticut, 2006. Morbidity and Mortality Weekly Report. 2008 April 4;57(13):340-3.

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 Infectious Diseases. 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. Clinical Infectious Diseases. 2008 Feb 15;46(4):497-504.

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 2010 through 2014. HCUP includes the largest collection of longitudinal hospital care data in the United States, with all-payer, encounter-level information beginning in 1988. The 2014 HCUP State Inpatient Databases (SID) encompass about 95 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 list of Partner organizations that contribute to HCUP databases is available in Appendix I.

METHODS

This analysis uses the HCUP SID from 2010 through 2014 from 41 States and the District of Columbia. CDI hospitalizations 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 percent) and specificity (99.7 percent) when using ICD-9-CM codes.⁷ This study was based on one hospital. Coding practices vary across hospitals and States, thereby affecting generalization of the results.

Rates were calculated as the number of CDI hospitalizations for adults per 1,000 adult, nonmaternal discharges treated in community, nonrehabilitation hospitals. 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. The rates of CDI hospitalizations are 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

Results are presented for the nation and four Census regions. Trend graphs demonstrate quarterly variation in the rates for 2010 through 2014. Appendix III includes the annual rates.

General Trends

National and regional trends showed variation in the rate of CDI stays per 1,000 adult, nonmaternal discharges from 2010 through 2014. The national annual rate of all CDI stays per 1,000 adult, nonmaternal discharges ranged from 12.1 in 2010 to 14.0 in 2014

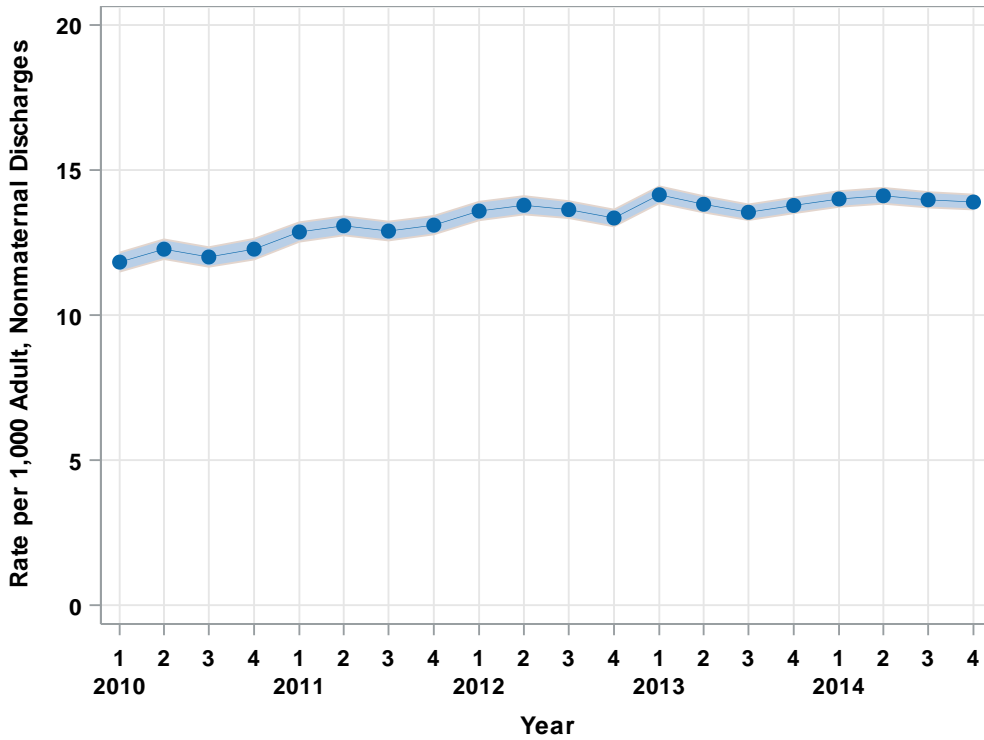
⁷ Dubberke ER, Reske KA, McDonald LC, Fraser VJ. ICD-9 codes and surveillance for *Clostridium difficile*-associated disease. *Emerging Infectious Diseases*. 2006 Oct;12(10):1576-9.

(an increase of 15.7 percent). When the CDI diagnosis was present on admission, there was an increase of 19.7 percent in the national annual rate of CDI stays from 2010 through 2014. In contrast, there was an increase of 3.5 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 rate of CDI hospitalizations, it cannot be determined whether this reflected an increase in unique cases. That distinction is beyond the limits of the data used.

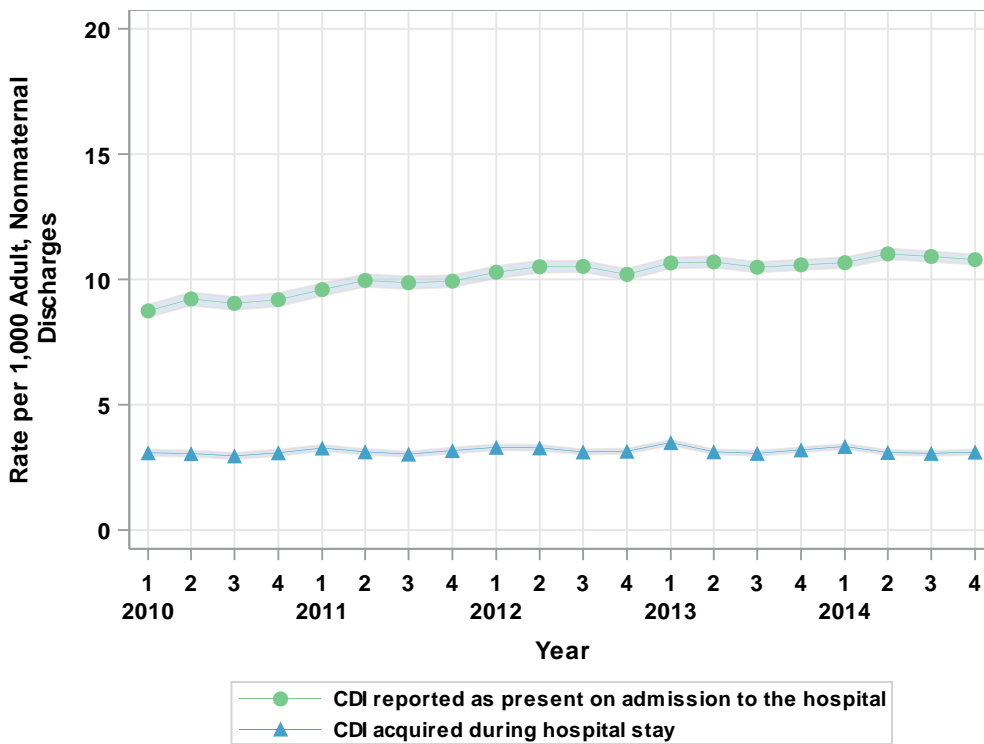
In the Northeast region, the annual rate of all CDI stays was about 14.5 stays per 1,000 adult, nonmaternal discharges from 2010 through 2014, with some quarterly variation. The annual rates of all CDI stays in the other regions in 2010 were lower than the Northeast (Midwest, 12.8; South, 10.9; West, 11.8), but the annual rates in these regions increased by more than 10 percent from 2010 through 2014. In addition, the annual rates when the CDI diagnosis was present on admission increased by more than 15 percent in all regions except the Northeast. Only the Midwest region showed any decrease in the annual rates when the CDI diagnosis was acquired during the hospitalization (–1.0 percent). In the other three regions, the annual rates when the CDI diagnosis was acquired during the hospitalization increased by less than 10 percent (Northeast, 1.0 percent; South, 5.3 percent; West, 9.8 percent).

National Trends

Rates for All CDI Stays



Rates for CDI Stays by Diagnosis Present on Admission



Trends by Census Region

In 2010, the annual rates of *all CDI stays* per 1,000 adult, nonmaternal discharges ranged from 10.9 in the South to 14.1 in the Northeast.

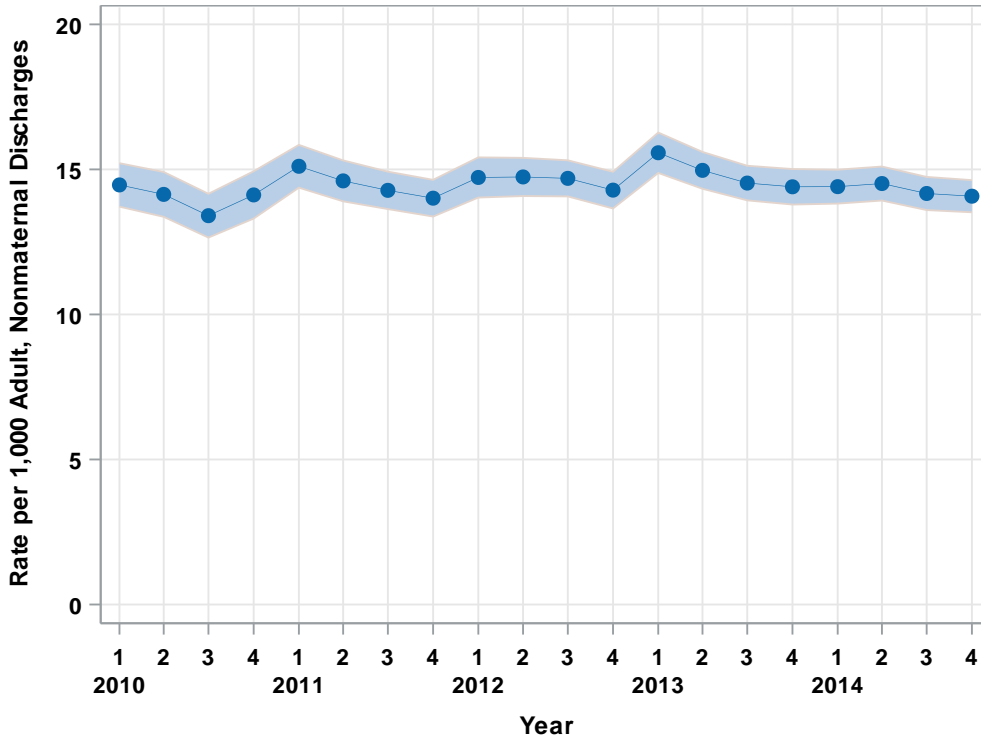
When the CDI diagnosis was present on admission, the 2010 annual rates ranged from 8.0 in the South to 10.5 in the Northeast. In 2014, the lowest rate was in the South (10.3) and the highest rate was in the West (11.6).

When the CDI diagnosis was acquired during the hospitalization, the 2010 annual rates ranged from 2.8 in the South to 3.6 in the Northeast. In 2014, the lowest rates were in the South and West (3.0) and the highest rate was in the Northeast (3.6).

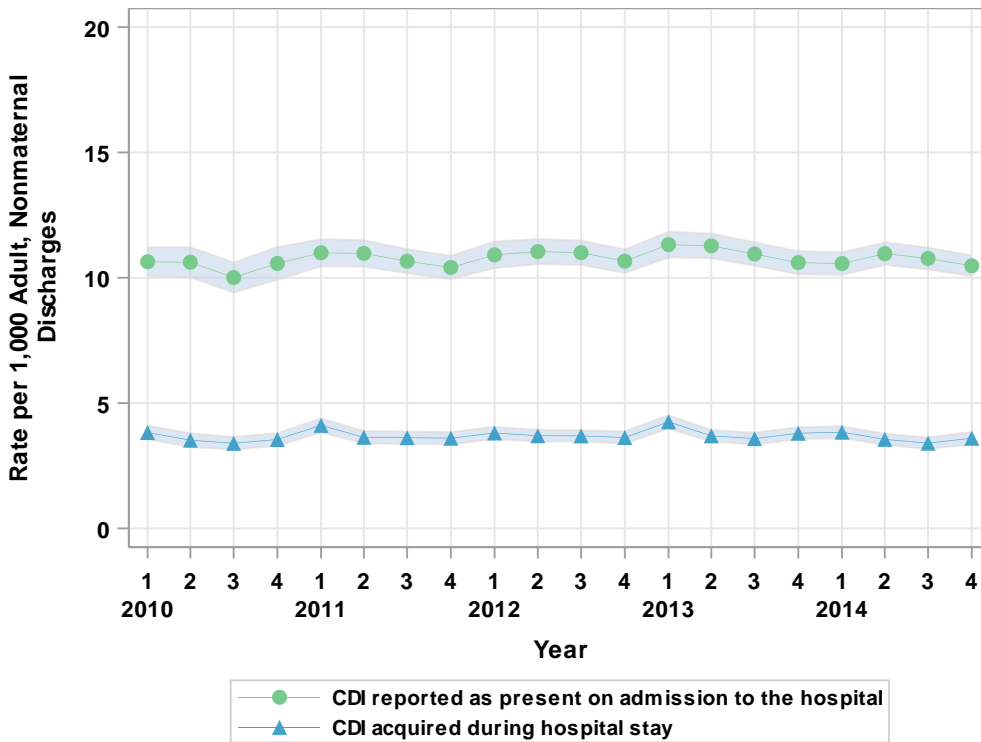
The following figures show the quarterly rates of CDI stays per 1,000 adult, nonmaternal discharges for the years 2010 through 2014 by Census region.

Northeast Region

Rates for All CDI Stays

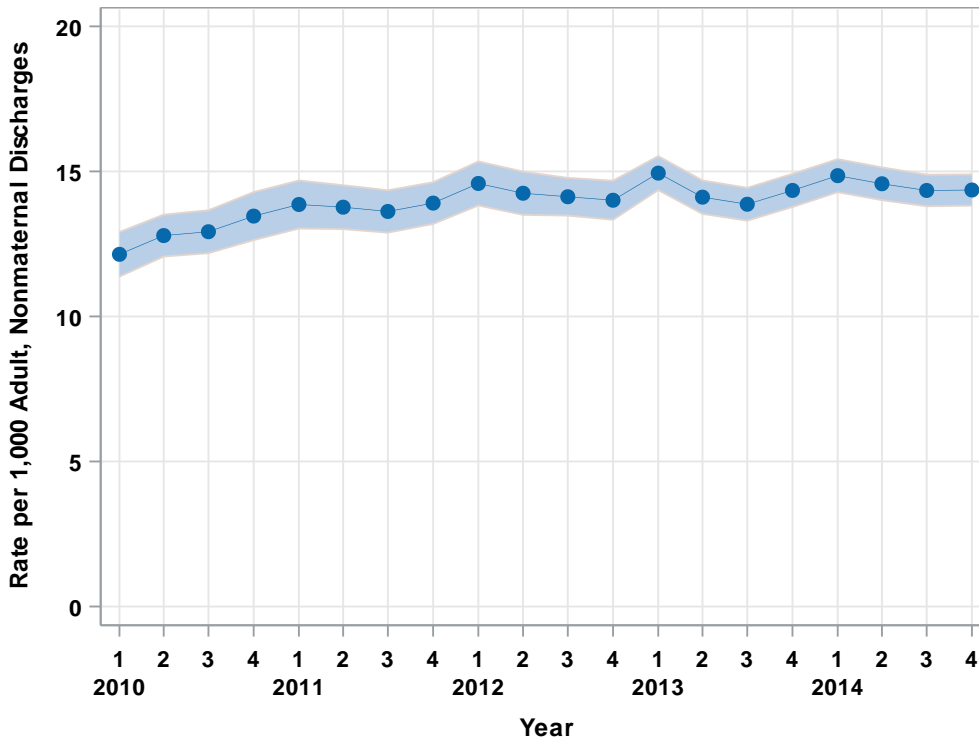


Rates for CDI Stays by Diagnosis Present on Admission

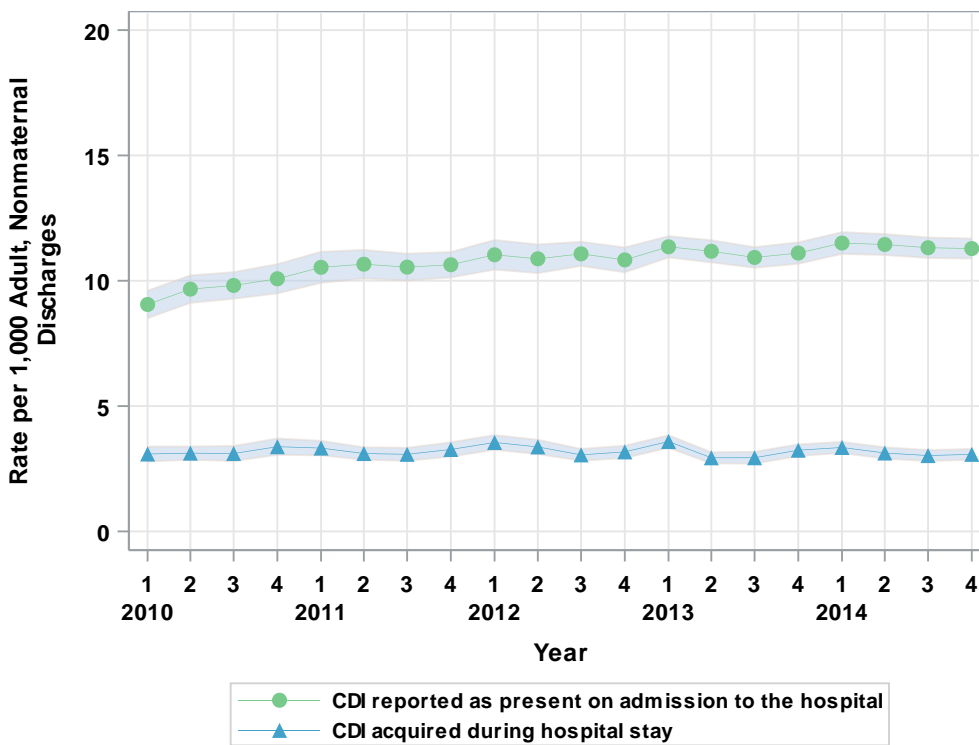


Midwest Region

Rates for All CDI Stays

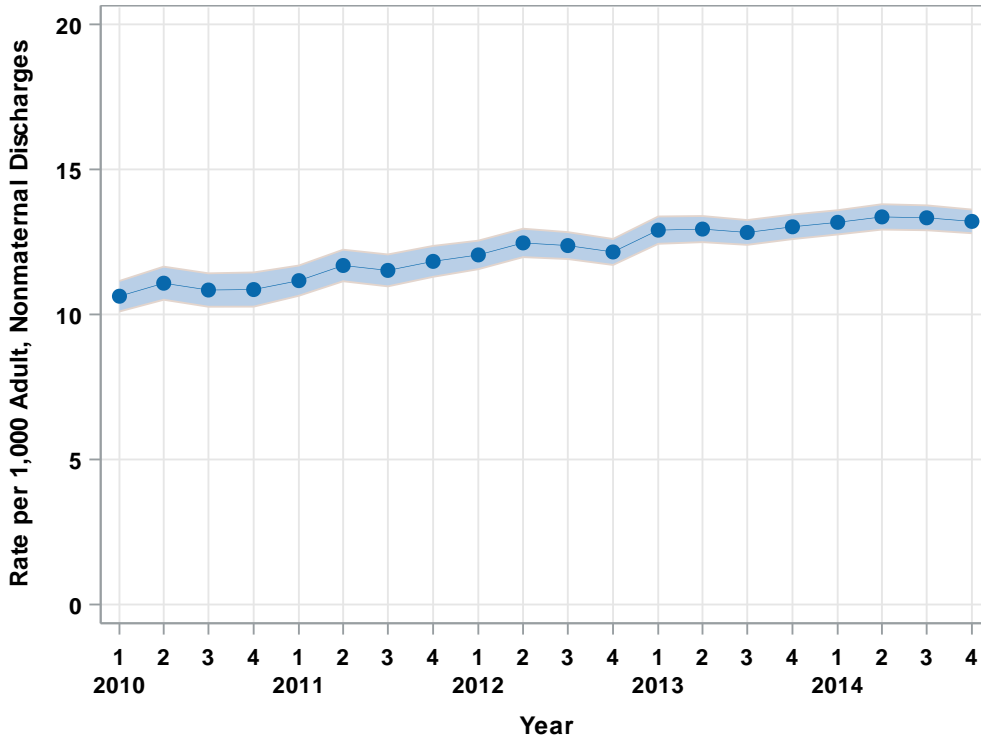


Rates for CDI Stays by Diagnosis Present on Admission

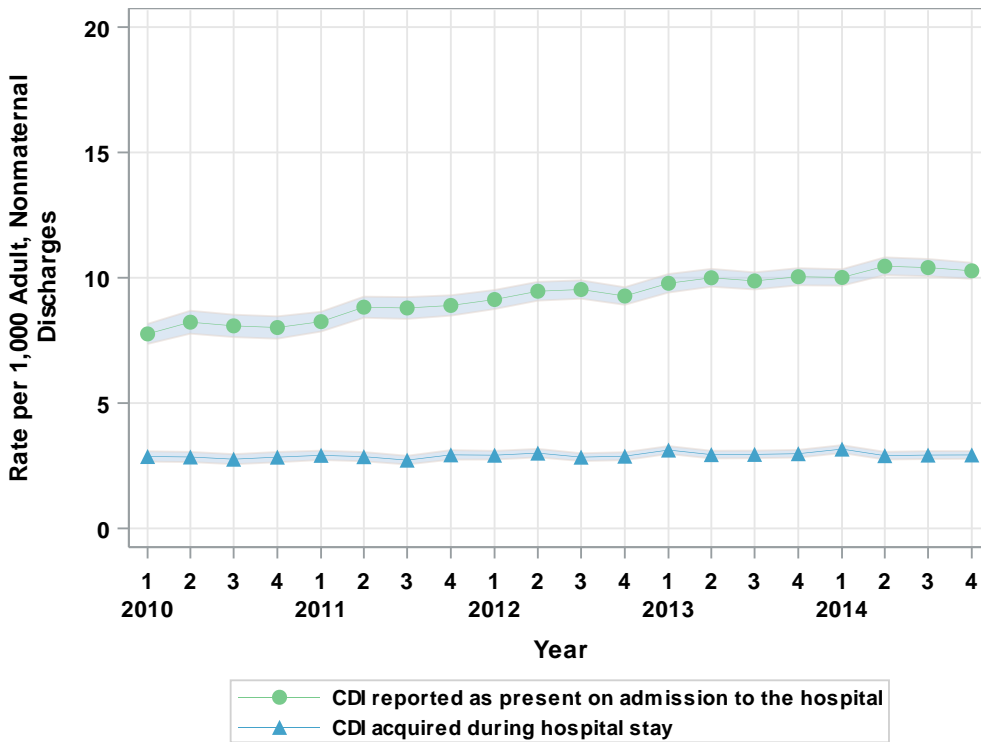


Southern Region

Rates for All CDI Stays

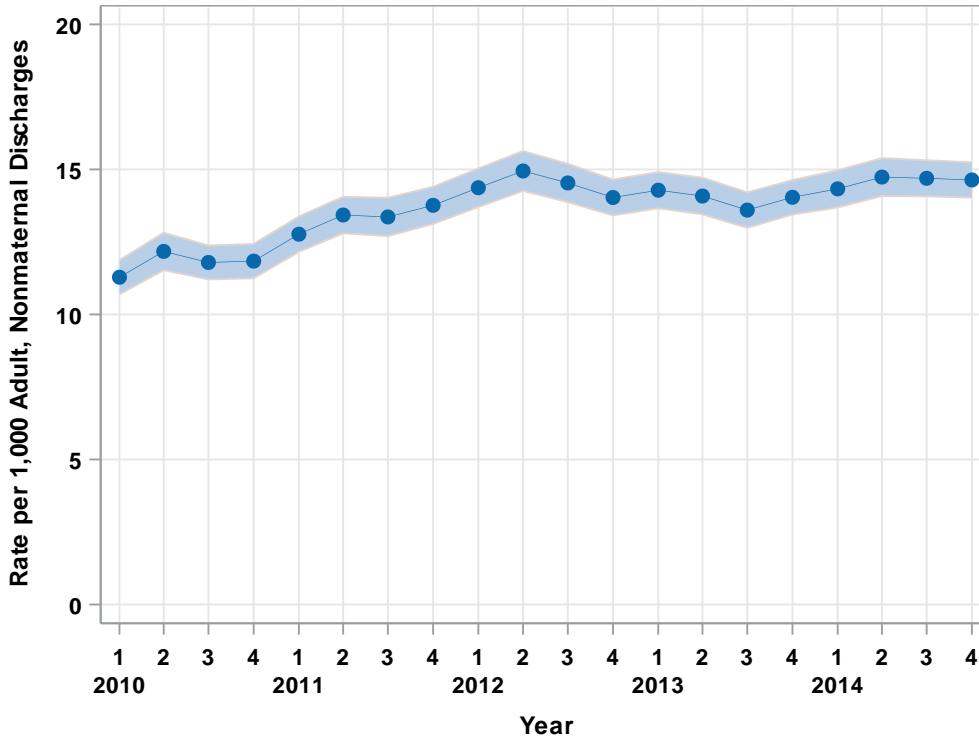


Rates for CDI Stays by Diagnosis Present on Admission

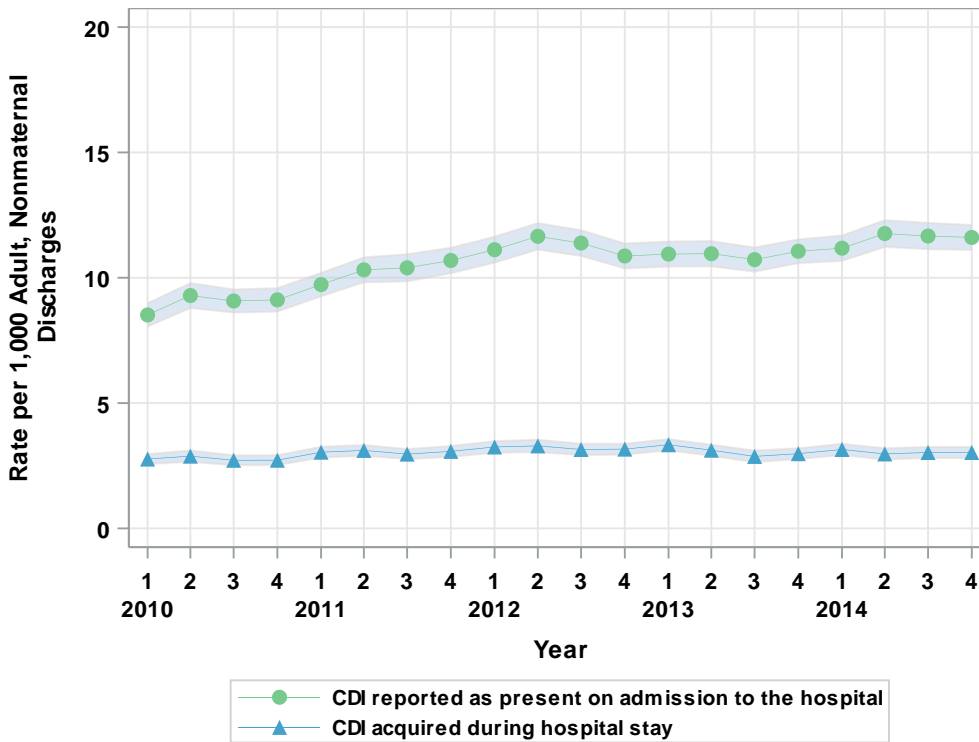


Western Region

Rates for All CDI Stays



Rates for CDI Stays by Diagnosis Present on Admission



APPENDIX I: HCUP PARTNERS

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 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 (provides data for Minnesota and North Dakota)

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

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 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 *Clostridium difficile* infection (CDI) hospitalizations per 1,000 adult, nonmaternal hospitalizations using the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) from 2010 through 2014.

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. CDI hospitalizations 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. 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 41 SID that included the POA data elements in 2014. 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 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.

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>.

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

	2010			2011			2012			2013			2014		
	All CDI Stays	CDI Reported as Present on Admission	CDI Acquired During Hospital Stay	All CDI Stays	CDI Reported as Present on Admission	CDI Acquired During Hospital Stay	All CDI Stays	CDI Reported as Present on Admission	CDI Acquired During Hospital Stay	All CDI Stays	CDI Reported as Present on Admission	CDI Acquired During Hospital Stay	All CDI Stays	CDI Reported as Present on Admission	CDI Acquired During Hospital Stay
Nation															
Total U.S.	12.11	9.06	3.05	12.99	9.84	3.15	13.60	10.38	3.21	13.84	10.61	3.22	14.01	10.85	3.15
Census Regions															
Northeast	14.08	10.51	3.57	14.54	10.79	3.74	14.64	10.93	3.71	14.91	11.08	3.83	14.34	10.73	3.61
Midwest	12.83	9.65	3.17	13.79	10.59	3.19	14.24	10.95	3.29	14.32	11.14	3.18	14.53	11.39	3.14
South	10.85	8.02	2.83	11.55	8.69	2.86	12.26	9.35	2.91	12.92	9.92	3.00	13.27	10.29	2.98
West	11.77	9.00	2.77	13.32	10.28	3.05	14.47	11.26	3.21	14.00	10.92	3.08	14.60	11.55	3.05

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), 2010–2014, weighted to provide national and regional estimates.