



Major article

Racial and ethnic disparities in health care–associated *Clostridium difficile* infections in the United States: State of the scienceSandra Yang MPH^{a,*}, Briana B. Rider PharmD^a, Avi Baehr BA^{a,b}, Aaron R. Ducoffe MD^a, Dale J. Hu MD, MPH^a^a Office of Disease Prevention and Health Promotion, US Department of Health and Human Services, Rockville, MD^b Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA

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Background: Among health care-associated infections (HAIs), *Clostridium difficile* infections (CDIs) are a major cause of morbidity and mortality in the United States. As national progress toward CDI prevention continues, it will be critical to ensure that the benefits from CDI prevention are realized across different patient demographic groups, including any targeted interventions.

Methods: Through a comprehensive review of existing evidence for racial/ethnic and other disparities in CDIs, we identified a few general trends, but the results were heterogeneous and highlight significant gaps in the literature.

Results: The majority of analyzed studies identified white patients as at increased risk of CDIs, although there is a very limited literature base, and many studies had significant methodological limitations.

Conclusion: Key recommendations for future research are provided to address antimicrobial stewardship programs and populations that may be at increased risk for CDIs.

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Health care–associated infections (HAIs), or infections acquired while receiving treatment for another condition in a health care setting, affect approximately 1 in 25 inpatients on any given day,^{1,2} contribute to thousands of preventable deaths, and cost the US health care system billions of dollars each year.³ For the individuals affected, these events have devastating medical, emotional, and economic consequences. The US Department of Health and Human Services (HHS) has identified HAIs as a priority area for all of its agencies, and is committed to reducing both the incidence and prevalence of these infections. Among other interagency initiatives, the HHS established the Federal Steering Committee for the Prevention of Health Care-Associated Infections. Led by the HHS Office of Disease Prevention and Health Promotion, the Steering Committee released the National Action Plan to Prevent Health Care-Associated Infections: Road Map to Elimination (HAI Action Plan) in 2009 (Table 1),⁴ and has maintained the HAI Action Plan as a

living document to best adapt to new and ongoing challenges and goals in the national strategy to prevent HAIs.

CDI prevention as a national priority

Among the preventable infections highlighted in the HAI Action Plan, *Clostridium difficile* infections (CDIs) are a major cause of morbidity and mortality in the United States. In 2011, CDIs affected nearly one-half million people, 83,000 of whom experienced a recurrence and 29,000 of whom died within 30 days of diagnosis.⁷ This burden is borne disproportionately by older adults, with more than 90% of deaths from CDI occurring in persons aged ≥ 65 years.⁸ Among adult inpatients at acute care hospitals, CDIs cost the US health care system an estimated \$1.5 billion annually⁹; however, because traditional hospital-based surveillance approaches do not typically include outpatient encounters, a substantial proportion of CDI cases may be missed,¹⁰ and thus the true burden of disease and annual costs of CDIs could be far higher.

CDIs are prioritized as an ongoing patient safety challenge that continues to have a significant impact on patient morbidity and mortality. The incidence of CDI nearly doubled between 2001 and 2010. In 2011, CDI was responsible for almost one-half million infections and 29,000 deaths in the United States.⁷ More recent data

* Address correspondence to Sandra Yang, MPH, Division of Health Care Quality, Office of Disease Prevention and Health Promotion, US Department of Health and Human Services, 1101 Wootton Pkwy, Ste 200, Rockville, MD 20852.

E-mail address: sandra.yang@hhs.gov (S. Yang).

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Conflicts of interest: None to report.

Table 1
CDIs as a national priority

Initiative	Brief Description
National Action Plan to Prevent Health Care–Associated Infections: Road Map to Elimination (HAI Action Plan) ⁴	Provides a road map for preventing HAIs, including CDIs, in acute care hospitals, ambulatory surgical centers, end-stage renal disease facilities, and long-term care facilities.
National Action Plan for Combating Antibiotic-Resistant Bacteria ⁵	Outlines federal activities over the next 5 years to enhance domestic and international capacity to prevent and contain outbreaks of antibiotic-resistant infections; maintain the efficacy of current and new antibiotics; and develop and deploy next-generation diagnostics, antibiotics, vaccines, and other therapeutics. Specifically calls for a 50% reduction in CDI incidence by 2020.
Department of Defense's Multidrug-Resistant Organism Repository and Surveillance Network ⁶	Centralizes and standardizes the collection, characterization, and reporting of multidrug-resistant organisms across the military health system to inform infection control, antibiotic use, and health care policy. To include CDIs by 2016.

suggest a 10% decline in hospital-onset CDIs from 2011 to 2013¹¹; however, some hospital discharge data suggest increasing CDI rates.^{12,13} The discrepancies in reported rates may be related to the widespread adoption of more sensitive diagnostics, active versus passive surveillance, and different definitions of CDI.^{7,14}

In 2013, the Centers for Disease Control and Prevention (CDC) classified CDIs as an “urgent threat.”¹⁵ In March 2015, the White House released the National Action Plan for Combating Antibiotic-Resistant Bacteria (Table 1),⁵ which establishes aggressive targets aimed at reducing CDIs in the coming years. The Action Plan calls for the Department of Defense's Multidrug-Resistant Organism Repository and Surveillance Network (MRSN) to include CDIs in its detection and reporting capabilities by 2016 (Table 1). It also calls for the CDC's Emerging Infections Program to fund large-scale pilot interventions to reduce CDIs, and specifies the goal of a 50% reduction in CDI incidence from 2011 levels by 2020.

In addition to the Action Plan, important strategies for CDI prevention include reducing unnecessary antibiotic use and implementing antibiotic stewardship programs (ASPs).¹⁶ ASPs can optimize the treatment of infections and reduce the adverse events associated with antibiotic use, such as CDIs.^{17,18} Antibiotic overuse is a major risk factor for CDIs and has contributed to the growing problem of CDIs. Thus, it is important identify populations, such as racial/ethnic groups, that have the highest rates of unnecessary antibiotic use to identify groups that may be especially vulnerable to CDIs.

Racial and ethnic health disparities

There is compelling evidence of racial and ethnic disparities in health care,¹⁹ an issue highlighted by the 1985 Report of the Secretary's Task Force on Black and Minority Health, the first comprehensive government account of the health disparities affecting racial and ethnic minorities in the United States.²⁰ Although a significant body of literature has demonstrated racial and ethnic disparities in a variety of health care quality domains, relatively little has been documented regarding the presence or absence of these disparities for HAIs in general or CDIs in particular. It will be critical to ensure that the benefits from CDI prevention are realized across different patient demographic groups, and that any vulnerable populations are identified and targeted for

interventions. To determine the state of evidence for identifying certain patient populations bearing an undue burden from CDIs, we performed a comprehensive literature review to survey evidence for racial or ethnic disparities in CDIs.

State of the evidence for racial and ethnic disparities in CDI

After a literature search of commonly used electronic databases (MEDLINE, Embase, Cochrane Library, and Cumulative Index to Nursing and Allied Health Literature) and a supplementary Web-based search, we identified 10 key articles assessing racial or ethnic disparities in CDIs in the United States (Table 2). Articles included in this review were limited to those published between 2005 and 2015 to capture the most recent trends in demography and health care utilization, especially antibiotic use. Owing to significant changes in antibiotic selection over the past 2 decades, earlier studies may yield results that are irrelevant to the present environment, given both formularies and resistance.

Several studies have analyzed data from relatively large numbers of patients through hospital discharge data or selected samples, including surveillance data.^{7,21,22,24,26} Specific outcomes assessed included CDI rates via administrative claims data, immunoassay results, mortality, and/or recurrence rates. White and black patients were the most commonly analyzed racial groups, and most studies analyzed Hispanics as a separate ethnic group. A limited number of studies analyzed Asians, and only 1 study included Native Americans/American Indians as a separate group for analysis.

Eight of the identified studies demonstrated an association between race and CDIs (Table 3). Most of these studies identified white race as a risk factor for CDIs,^{7,26,27} and 1 study found an association between white race and a higher rate of postdischarge CDI.²⁸ Given that whites are more likely than other groups to have a specific source of ongoing care,¹⁹ they may have greater access to certain treatment options, such as antimicrobial therapy. Thus, whites have the potential for greater cumulative exposure to antibiotics, which is the most widely known risk factor for CDIs.³⁰ However, Hicks et al³¹ identified the South census region as the region with the highest antibiotic prescription rate, where a larger proportion of the population are black compared to other US regions. Future studies should explore differences in antibiotic prescribing patterns specifically among racial and ethnic groups.

Two studies found higher rates of CDI and CDI recurrence in blacks than in whites,^{25,29} and 1 study of a national sample of inpatients identified Asians as being at greatest risk for CDI.²² In another study, Hispanic ethnicity was found to be predictive of postdischarge CDI.²⁸ One study found no racial or ethnic disparities in the incidence of CDIs among a limited orthopedic patient population at a single facility.²³ Another study using Medicare data found no difference in race among those with and without a CDI readmission.²⁴

Limitations of existing evidence

The studies included in the present review documented variable results and were rather heterogeneous. The few studies available on racial and ethnic disparities in CDIs were further limited owing to different methods of identifying patient race or ethnicity, disparate methodologies, and relatively small sample sizes.

The identified studies reported several different categories for racial and ethnic classification, and used a variety of methods to assess patient race or ethnicity. In recognition of the critical importance of standardized reporting on race and ethnicity data for the purposes of comparing data, the Office of Management and Budget has issued national standards for recordkeeping, collection,

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