

# Trends in the Contribution of Emergency Departments to the Provision of Health Care in the USA

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## Abstract

Traditional approaches to assessing the health of populations focus on the use of primary care and the delivery of care through patient-centered homes, managed care resources, and accountable care organizations. The use of emergency departments (EDs) has largely not been given consideration in these models. Our study aimed to determine the contribution of EDs to the health care received by Americans between 1996 and 2010 and to compare it with the contribution of outpatient and inpatient services using National Ambulatory Medical Care Survey and National Hospital Discharge Survey databases. We found that EDs contributed an average of 47.7% of the medical care delivered in the United States, and this percentage increased steadily over the 14-year study period. EDs are a major source of medical care in the United States, especially for vulnerable populations, and this contribution increased throughout the study period. Including emergency care

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within health reform and population health efforts would prove valuable to supporting the health of the nation.

**Keywords**

emergency Care, population health, health care delivery

Population health is traditionally defined as the “health of geographic populations” and includes both traditional determinants of health (genetics, individual behaviors, etc.) and social determinants of health (social and physical environment). Previous literature has suggested that the contribution of the medical care system – in all aspects – to overall health is 20%.<sup>1,2</sup> Because of that association, hospitals and clinicians strive to optimize the public’s access to high-quality health care while concomitantly controlling costs.

As described in Healthy People 2020 (<https://www.healthypeople.gov/>), access to health care has a role in health equity and quality of life.<sup>3</sup> Thirty-five years ago, Penchansky and Thomas<sup>4</sup> defined ‘access’ as a general concept encompassing specific dimensions that describe the “fit” between the consumer and the health care system. Those dimensions are accessibility, availability, acceptability, affordability, and accommodation. Barriers to any of these concepts can lead to unmet medical needs, delays in receiving appropriate care, inability to get appropriate services, and hospitalizations that could have been prevented.<sup>5</sup>

As an entry point to the health care system, the emergency department (ED) serves a critical role. The National Center for Health Statistics cites 44.5 ED visits per 100 persons in the United States in 2015, and 12% of these encounters resulted in hospitalization. In every community, EDs play an important social role, guaranteeing assistance to vulnerable populations, including uninsured and low-income individuals.<sup>6,7</sup> Thus, EDs are an essential contributor to the health of a population, with the use of EDs a well-defined measure of this contribution.<sup>8</sup>

To optimally manage the health of a population, it is important to understand how and where its members receive medical care. Traditional approaches to assessing the health of populations focus on the use of primary care and the delivery of care through patient-centered homes, managed care resources, and accountable care organizations. The use of EDs has not been given much consideration in these models.

We sought to determine the contribution of EDs to the health care received by Americans between 1996 and 2010 and to compare it with the contribution of outpatient and inpatient sectors.

## Methods

### *Study Design*

The goal of our study was to assess the contribution of emergency departments in the provision of health care in the United States from 1996 to 2010, comparing it against the combined contribution of outpatient and inpatient sectors. This study is described according to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.<sup>9</sup>

### *Ethics*

The Institutional Review Board of the University of Maryland approved our study. Since a publicly available database with no identifiable information was used in this project, no informed consent was sought from participating patients.

### *Database*

The data were obtained from two annual, nationally representative surveys conducted in the United States, namely the National Hospital Ambulatory Medical Care Survey (NHAMCS) and the National Hospital Discharge Survey (NHDS). Both are conducted by the Centers for Disease Control's National Center for Health Statistics. Datasets from 1996 to 2010 were included in the analysis. Our primary reason for choosing the 1996–2010 period was that, beginning in 2011, the dataset was restructured, combining all three datasets and imposing a new set of methods to conduct the survey. For example, the new survey does not use the same sampling previously employed for freestanding surgery centers.<sup>10</sup> While the new methods have certainly led to improvement in a number of areas, they have also generated some discontinuity that could make the comparison of previous years unreliable.

The NHDS is a national probability survey collecting information on characteristics of inpatients discharged from short-term, non-federal hospitals located in the 50 states and the District of Columbia. The following were excluded from the NHDS: federal, military, and Veterans Health Administration hospitals; institutional hospital units; and hospitals with fewer than 6 beds staffed for patient use and with average lengths of stay of 30 days or greater for all patients. NHDS uses a 3-stage sample design, constituted by primary sampling units (PSUs), hospitals within PSUs, and discharges within hospitals. From a national sample of about 500 hospitals, NHDS collected nearly 270,000 inpatient records every year from 1988 to 2007. From 2008 to 2010, the sample size was reduced to 239 hospitals ([http://www.cdc.gov/nchs/nhds/about\\_nhds.htm](http://www.cdc.gov/nchs/nhds/about_nhds.htm), last accessed September 2017). Discharge data were collected by one of two methods. First, manual data abstraction from medical records was conducted by hospital staff or by staff from the United States

Bureau of the Census. The second source constitutes the purchase of automated electronic data files from commercial organizations, state data systems, hospitals, and hospital associations. These files contain data related to patients' personal characteristics, including age, sex, race, ethnicity, marital status, and expected sources of payment, and administrative items, such as admission and discharge dates, discharge status, and medical information about patients, including diagnoses and procedures coded in accordance with the International Classification of Diseases, Ninth Revision, Clinical Modification (<http://www.cdc.gov/nchs/icd/icd9cm.htm>, last accessed June 2016).

The NHAMCS is a national probability survey, collecting data from hospital outpatient and emergency departments located in non-institutional, general, and short-stay facilities, excluding federal, military, and Veterans Affairs hospitals. These are located in 50 states and the District of Columbia. NHAMCS uses a four-stage probability sampling design involving geographically defined regions, hospitals within these areas, clinics within hospitals, and patient visits within clinics. The data collection procedure includes completion of patient record forms reflecting provider types, the reason for visit, diagnoses, drugs, and selected procedures, as well as tests performed during the visit. Also, patient demographics, payment methods, and selected hospital characteristics are collected ([http://www.cdc.gov/nchs/ahcd/about\\_ahcd.htm](http://www.cdc.gov/nchs/ahcd/about_ahcd.htm), last accessed June 2016).

Both databases provide visit rather than patient data, meaning that patients cannot be tracked over time.

### *Participants*

The study sample includes all patients visiting emergency and outpatient departments as well as inpatients discharged from nonfederal, short-stay, or general hospitals in the NHAMCS and NHDS surveys, respectively (Table 1).

### *Variables*

We generated estimates for the United States for the number visits across different strata, including age, gender, race (white, black, Asian, and Native American), source of payment (Medicare, Medicaid, Health Maintenance Organization, other), and metropolitan statistical area (MSA, classified as urban or rural area). The original dataset uses the following payment categories: 1 = private insurance, 2 = Medicare, 3 = Medicaid or CHIP/SCHIP, 4 = workers' compensation, 5 = self-pay, 6 = no charge/charity, 7 = other. The individual components for what we classified as "other" (workers' compensation, self-pay, no charge/charity, and other) make it a fairly small fraction, which fluctuated over the years. This led us to aggregate them into a single category named "other." The MSA is defined by the United States Office of

**Table 1.** Individual Estimates Per Year.

Survey Year	Emergency Department	Outpatient	Inpatient
2010	129,843,377	100,742,059	38,919,168
2009	136,072,130	96,132,277	40,253,695
2008	123,761,419	109,888,574	39,843,822
2007	116,802,066	88,893,929	38,416,311
2006	119,191,528	102,208,171	34,853,896
2005	115,322,815	90,392,952	34,667,315
2004	110,216,408	84,993,769	34,864,166
2003	113,903,194	94,577,567	34,738,411
2002	110,154,563	83,339,070	33,726,611
2001	107,490,168	83,715,060	32,652,589
2000	108,016,777	83,288,796	31,705,672
1999	102,764,669	84,623,270	32,131,877
1998	100,385,193	75,412,126	31,826,545
1997	94,935,575	76,992,555	30,914,167
1996	90,346,724	67,185,657	30,544,614

Management and Budget and involves two considerations: first, a city or cities of specified population constituting the central city and identifying the county in which it is located as the central county; second, economic and social relationships with “contiguous” counties being metropolitan in character so that the periphery of the particular metropolitan area may be determined. All variables were collected through patient record form abstraction.

**Statistical Methods**

Our exploratory analysis started by evaluating distributions, frequencies, and percentages for each of the numeric and categorical variables. Categorical variables were assessed for near-zero variation.<sup>11</sup> Extensive graphical displays were used for both univariate analysis and bivariate associations, accompanied by broader tests such as Maximal Information Coefficient<sup>12</sup> and Nonnegative Matrix Factorization<sup>13</sup> algorithms for numeric variables. Missing data were explored using a combination of graphical displays involving univariate, bivariate, and multivariate methods. Imputation was performed using a k-nearest neighbors algorithm (n = 5).<sup>14</sup>

Population estimates were generated through masked sample design variables, patient weights, clustered primary sampling units (PSU) markers (CPSUM), and clustered PSU stratum markers (CSTRATM). All calculations were performed using the R language<sup>15</sup> and its the survey package.

Analyses were adjusted for year-specific survey weights, strata, and primary sampling units. Year-specific adjustment is a use foreseen in the original survey design, ensuring that our results represent the entire United States population for the study period.<sup>16,17</sup> Analyses were stratified by age, gender, race (white, black, Asian and Native American), the source of payment (Medicare, Medicaid, Health Maintenance Organization, other), and metropolitan statistical area (MSA) classified as urban or rural area. As information on MSA was not available for inpatients, this information is reported only for ED and outpatient facilities. All data were collected by abstraction from patient records. Our category of the black race included patients who were African Americans, black Latin Americans, and foreign black patients receiving care in the United States. Finally, we report our results with an overlap in confidence intervals as a trend rather than a statistically significant finding.

## Results

The descriptive analysis presents results adjusted for the corresponding set of survey weights, strata, and primary sampling units and can therefore be generalized for the United States population. Table 2 demonstrates the frequencies corresponding to inferences for the United States population; non-overlapping results represent statistically significant differences. The increase in use of EDs, outpatient services, and inpatient facilities over the 14-year study period is portrayed in Figure 1. Patients treated in EDs were significantly younger than those treated as outpatients or admitted as inpatients ( $P < .01$ ) but with a similar gender distribution. Black patients were significantly more likely to have ED visits ( $P < .001$ ) than patients self-classified as other racial groups. Patients in the other insurance category, which includes those without any type of insurance, were significantly more likely to have ED visits than any other group ( $P < .001$ ). Finally, patients in the South region were significantly more likely to have ED visits than patients in other areas ( $P < .001$ ).

### Overall Utilization

More than 3.5 billion ( $n = 3,521,651,297$ ) health care contacts (ED visits, outpatient visits, and hospital admissions) occurred between 1996 and 2010. ED visits increased by 43.7% over the study period and accounted for 47.7% (1,679,206,606) of health care contacts. In contrast, outpatient visits accounted for 37.6% (1,322,385,832) of contacts during the study period. Although inpatient care receives significant attention because of the associated costs, hospital admissions accounted for substantially fewer health care contacts than the other 2 categories, at 14.8% (520,058,859).

**Table 2.** Sample Characteristics With Population Inferences to the United States.

Variable	Emergency Department (129,843,377)	Outpatient (100,742,059)	Inpatient (38,919,168)
Age	36.71 (± 0.5)	40.43 (± 1.46)	48.59 (± 0.12)
Female	71,535,194 (55.1% ± 3.1%)	60,021,571 (59.6% ± 5.4%)	22,690,281 (58.3% ± 0.4%)
Race			
Asian	2,056,582 (1.8% ± 0.3%)	2,122,163 (2.5% ± 0.4%)	714,645 (2.3% ± 0.1%)
Black	25,920,760 (22.4% ± 2.3%)	17,017,048 (19.9% ± 3%)	5,419,344 (17.1% ± 0.3%)
Indian	527,800 (0.5% ± 0.2%)	401,982 (0.5% ± 0.2%)	174,792 (0.6% ± 0.1%)
White	87,025,763 (75.3% ± 4.6%)	65,766,813 (77.1% ± 8.3%)	25,298,131 (80% ± 0.6%)
Payment			
HMO	39,159,178 (31.7% ± 2%)	35,856,111 (36.9% ± 4.5%)	9,191,725 (24.4% ± 0.3%)
Medicaid	35,762,836 (28.9% ± 2%)	28,401,939 (29.2% ± 3%)	7,859,761 (20.9% ± 0.3%)
Medicare	22,945,648 (18.5% ± 1.1%)	22,071,011 (22.7% ± 3.1%)	14,696,199 (39% ± 0.4%)
Other	25,833,937 (20.9% ± 1.5%)	10,807,472 (11.1% ± 1.5%)	5,917,700 (15.7% ± 0.2%)
Metropolitan area			
MSA	107,799,057 (83% ± 6.5%)	84,346,461 (83.7% ± 9.7%)	
Non-MSA	22,044,320 (17% ± 4.8%)	16,395,598 (16.3% ± 5.7%)	
Region			
Midwest	27,730,580 (21.4% ± 2.7%)	29,391,179 (29.2% ± 4.7%)	8,803,682 (22.6% ± 0.2%)
Northeast	24,306,068 (18.7% ± 1.5%)	29,063,929 (28.8% ± 5.5%)	8,080,212 (20.8% ± 0.3%)
South	52,785,341 (40.7% ± 4.1%)	30,291,745 (30.1% ± 5.2%)	14,632,167 (37.6% ± 0.3%)
West	25,021,388 (19.3% ± 1.9%)	11,995,206 (11.9% ± 2.2%)	7,403,107 (19% ± 0.3%)

Abbreviations: HMO: health maintenance organization; MSA, metropolitan statistical area.

### Utilization Among Medicare and Medicaid Beneficiaries

For all Medicare visits after 2005, our evaluation of analysis showed an increase percentage of ED visits for these beneficiaries from 29.9% to 38.4%.

When we instead consider only patients having ED visits, we noticed a trend toward an increase in the percentage of patients making use of Medicare, shifting from 16.0% to 17.7%. This trend was more pronounced among female patients, shifting from 9.7% to 11.1%.

The use of EDs among Medicaid beneficiaries trended upward since 2008, shifting from 43.3% to 49.6% (Figure 2). From this year onward, the use of EDs in this group surpassed the care provided through outpatient departments, accounting for 39.4% of all outpatient visits in 2010.

When considering the isolated ED case mix, Medicaid as a source of payment showed a major increase in its contribution, shifting from 19.4% to 27.5% of all emergency care.

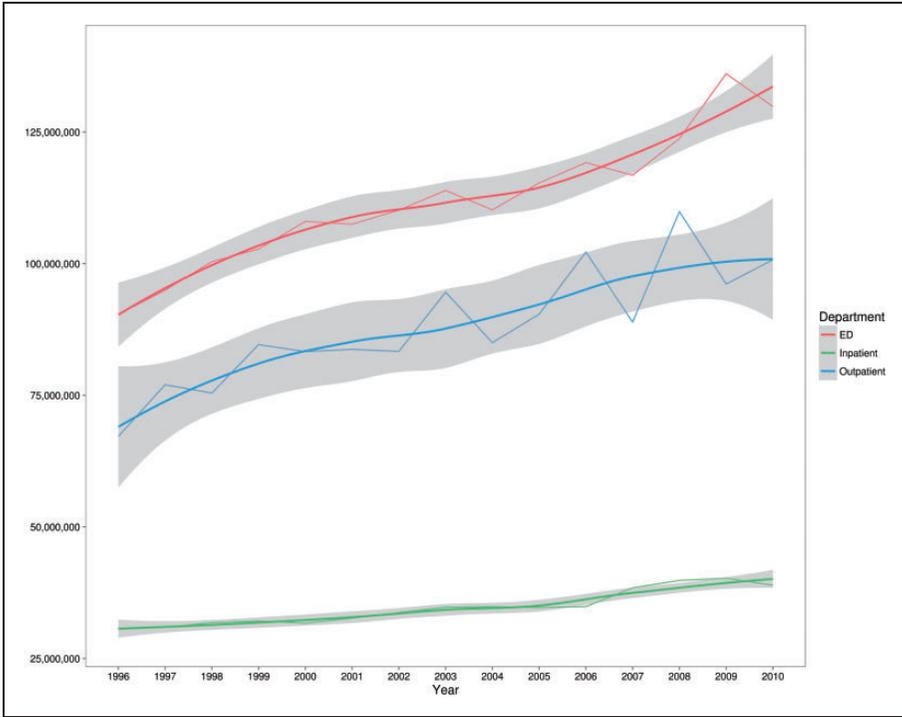


Figure 1. The number of health care contacts as ED visits, use of outpatient resources, and hospitalizations over a 14-year period. ED, emergency department.

### Utilization Among Different Racial Groups

In the following figures, we compare percentages of visits between racial groups across the 3 groups, all results being inferences to the United States population. Black patients made significantly more use of EDs than of inpatient and outpatient resources in nearly the entire study period. In 2010, of all the medical visits documented for black patients, 53.6% were in EDs, 35.2% in outpatient settings, and 11.2% in inpatient settings (Figure 3). An increase in ED use was particularly noticeable among black patients in metropolitan areas, moving from 49.1% in 1996 to 59.3% in 2010 (Figure 4). Among black patients receiving care under Medicaid, the use of EDs surpassed the number of outpatient visits in 2008, reaching 51.8% in 2010 (Figure 5). In contrast, black Medicare recipients had similar rates of ED visits and outpatient visits (42.0% and 37.7%, respectively; Figure 6). White and Asian patients showed relatively stable rates of ED use, at 48.9% and 42.0%, respectively, in 2010 (Figures 7 and 8).

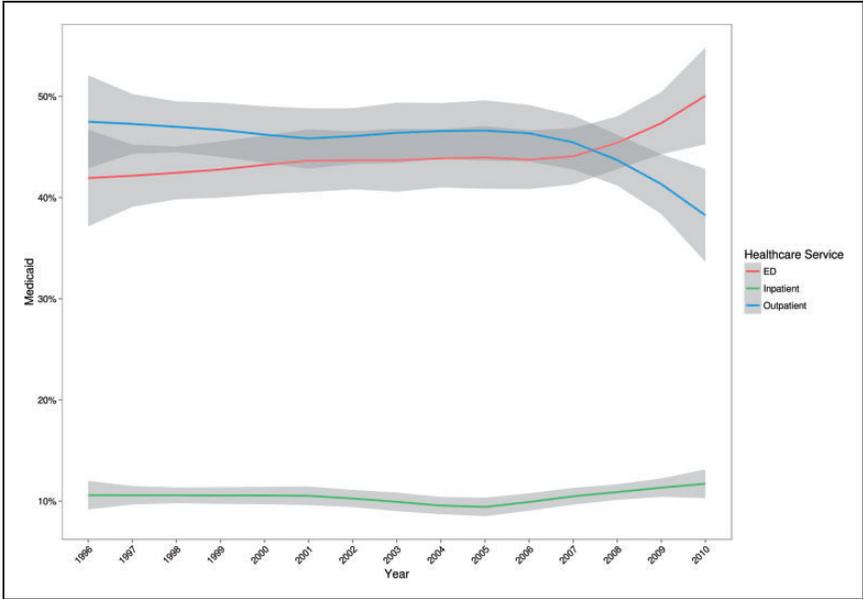


Figure 2. Patterns in the use of EDs, outpatient resources, and inpatient facilities by Medicaid recipients. ED, emergency department.

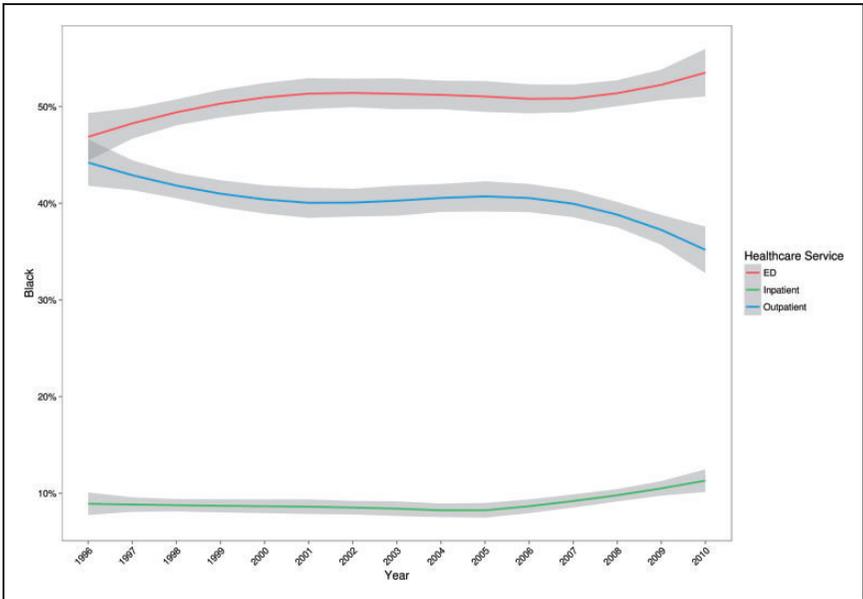


Figure 3. Patterns in the use of EDs, outpatient resources, and inpatient facilities by black people. ED, emergency department.

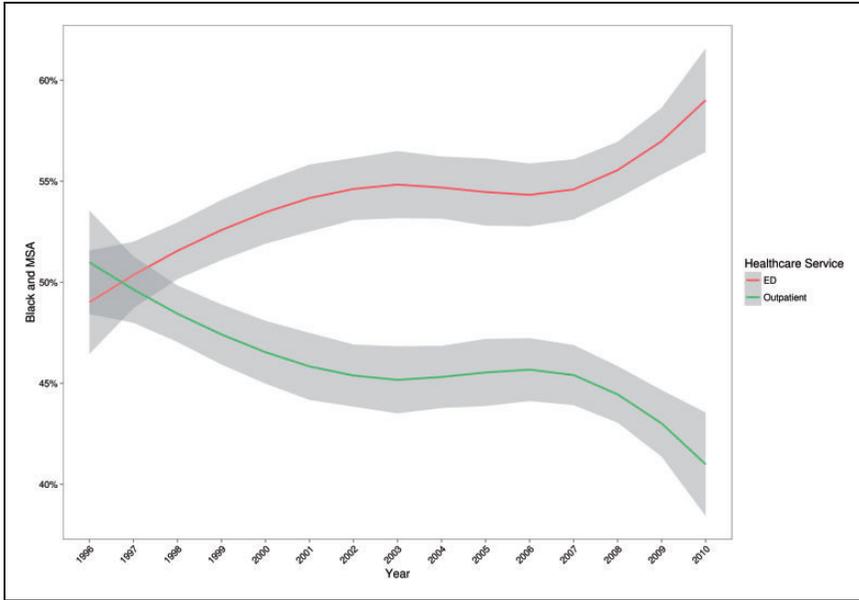


Figure 4. Patterns in the use of EDs and outpatient resources by black people living in metropolitan statistical areas. ED, emergency department; MSA, metropolitan statistical area.

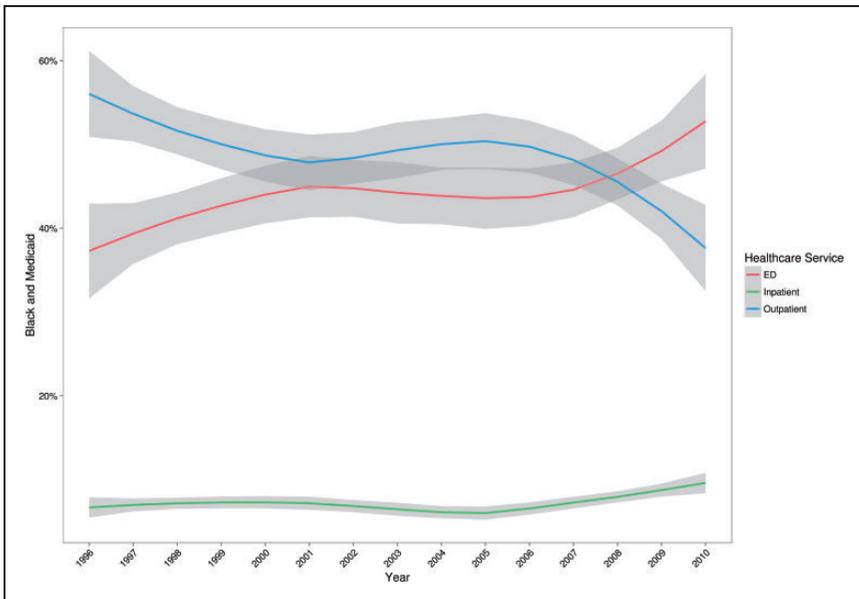


Figure 5. Patterns in the use of EDs, outpatient resources, and inpatient facilities by black people who are Medicaid recipients. ED, emergency department.

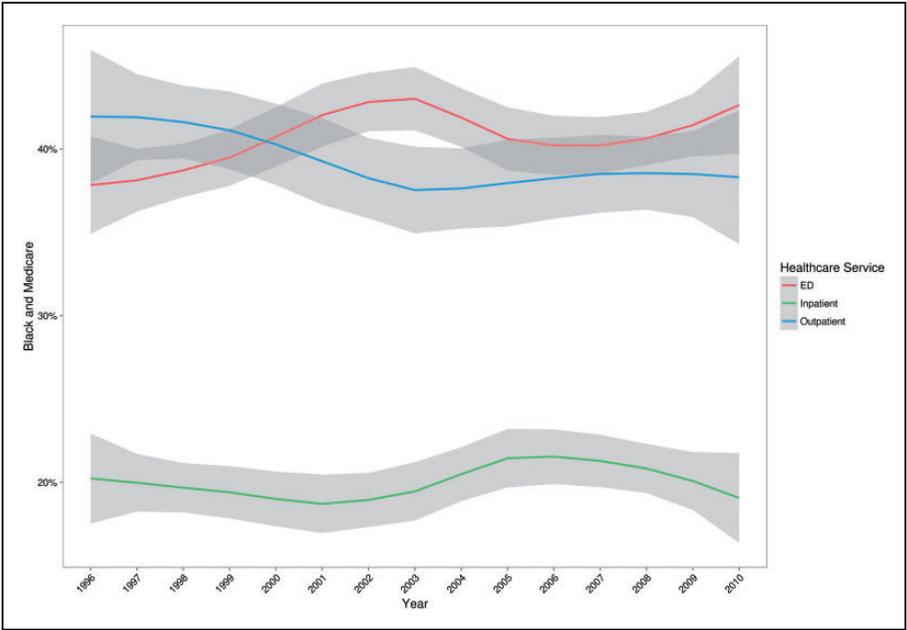


Figure 6. Patterns in the use of EDs, outpatient resources, and inpatient facilities by black people who are Medicare recipients. ED, emergency department.

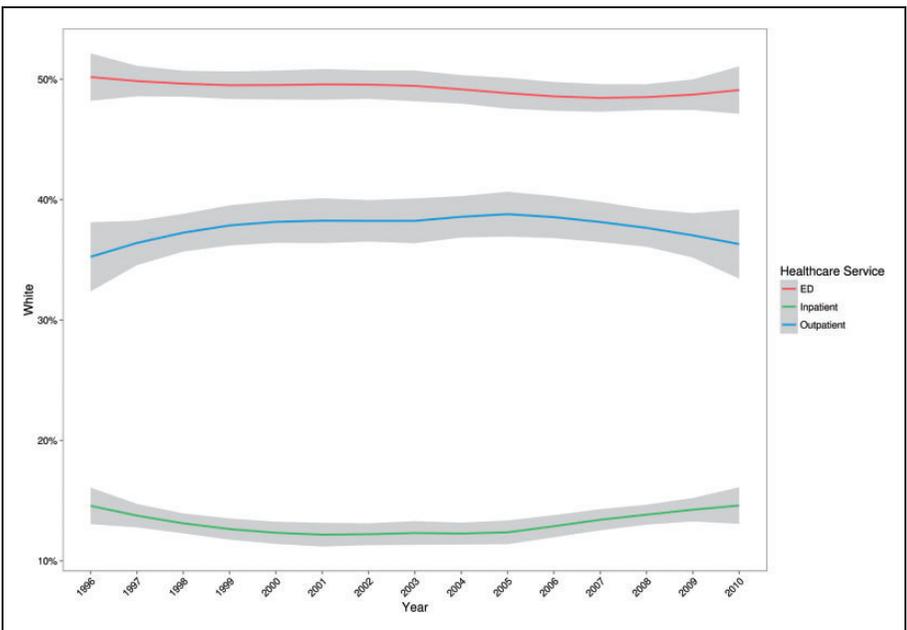


Figure 7. Patterns in the use of EDs, outpatient resources, and inpatient facilities by white people. ED, emergency department.

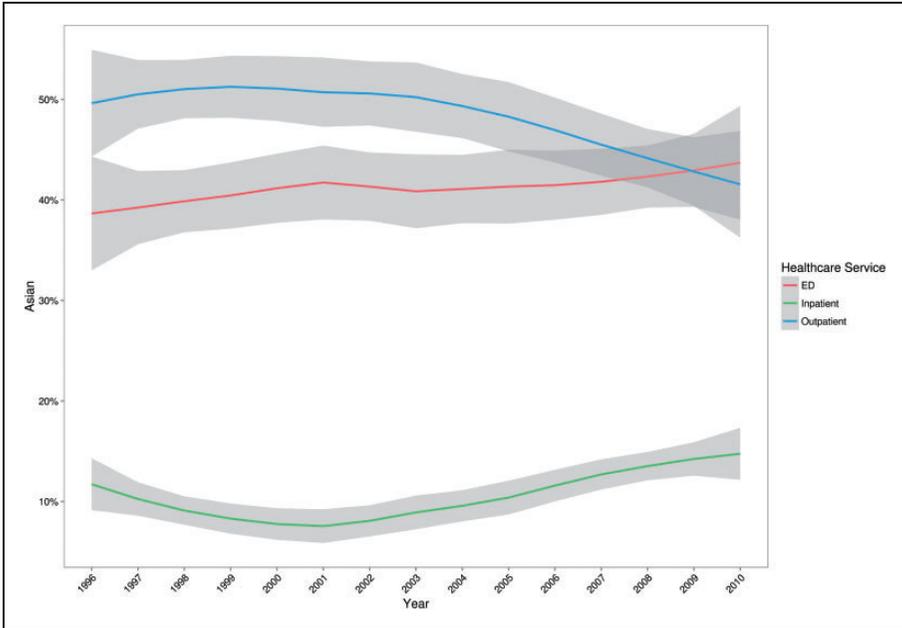


Figure 8. Patterns in the use of EDs, outpatient resources, and inpatient facilities by people of Asian heritage. ED, emergency department.

Evaluation of the isolated ED case mix showed that, in 2010, white (57.7%), black (15.7%), and Asian (1.6%) patients accounted for, respectively, 67.0%, 20.0%, and 1.6% of all visits.

### Utilization by Gender

Males and females demonstrated a stable ED utilization pattern, although men exhibited a slightly higher visit rate (50.6% vs 46.4%). Among female patients with encounters related to childbirth, the use of EDs increased from 1.7% in 1996 to 3% in 2010. Both genders have consistently used EDs more than inpatient and outpatient services. For example, in 2010, males accounted for 35.3% of all outpatient visits and 14.1% of all hospitalizations (Figure 9), while females accounted for 38.9% and 14.7%, respectively (Figure 10). Females who received Medicaid (Figure 11) and those residing in MSAs (Figure 12) showed significant increase in ED utilization during the study period.

Within the isolated ED case mix, the percentage of women increased progressively over time, in 2010 accounting for 55.1% of all emergency visits.

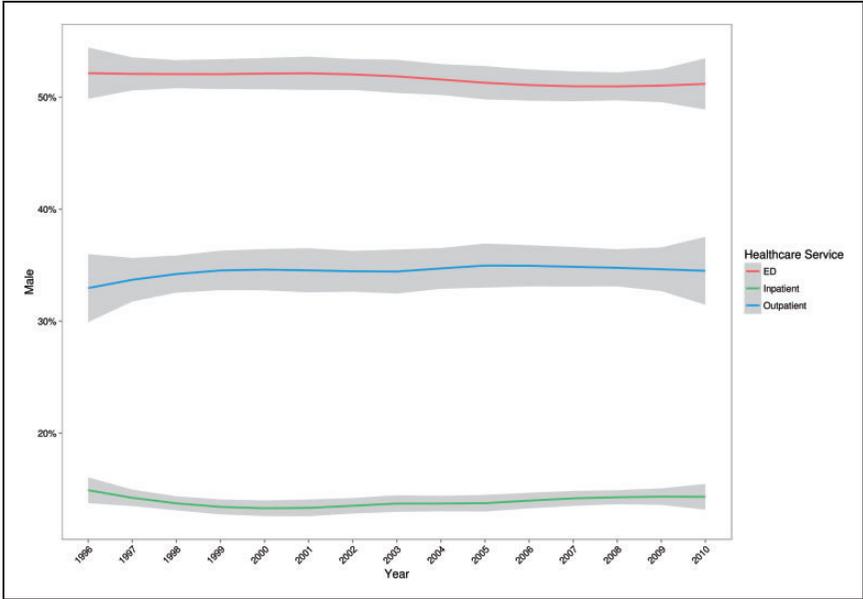


Figure 9. Patterns in the use of EDs, outpatient resources, and inpatient facilities by men. ED, emergency department.

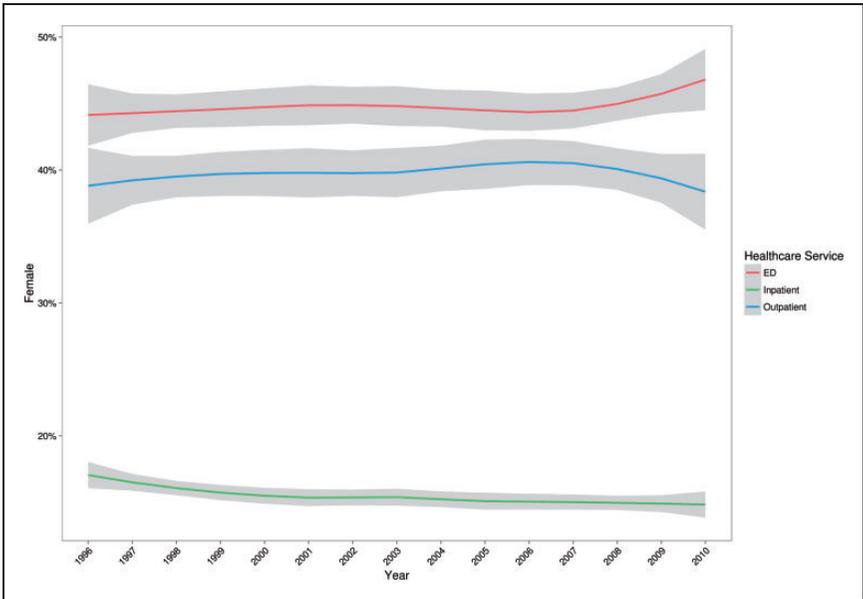


Figure 10. Patterns in the use of EDs, outpatient resources, and inpatient facilities by women. ED, emergency department.

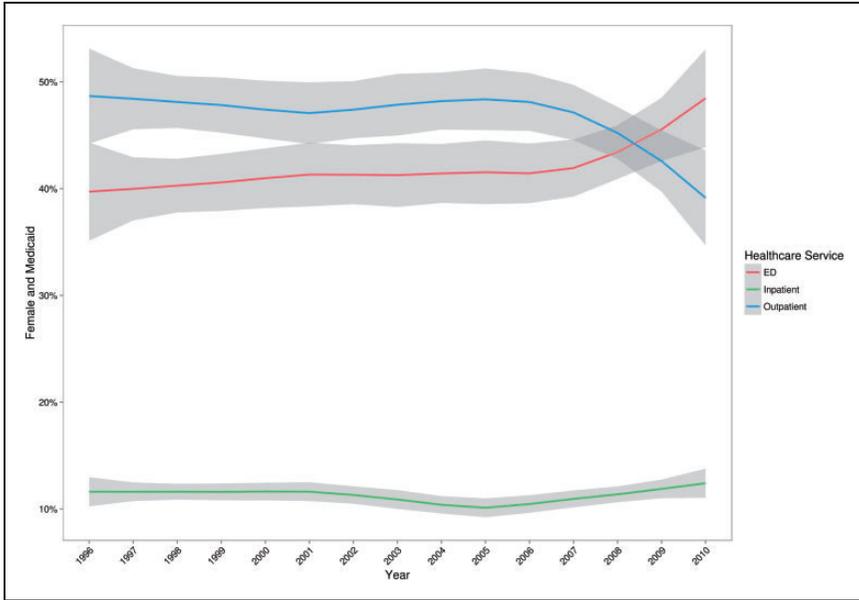


Figure 11. Patterns in the use of EDs, outpatient resources, and inpatient facilities by women who are Medicaid recipients. ED, emergency department.

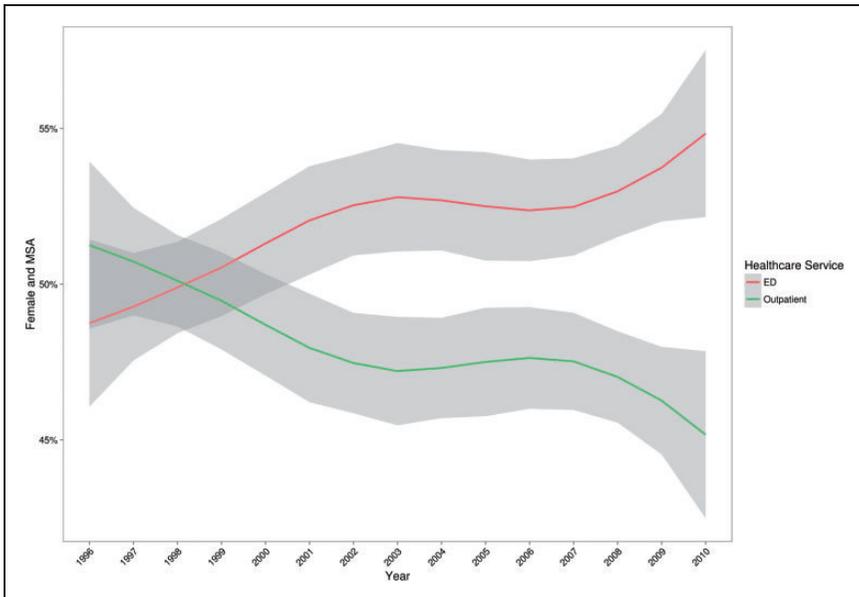


Figure 12. Patterns in the use of EDs and outpatient resources by women who live in metropolitan statistical areas. ED, emergency department; MSA, metropolitan statistical area.

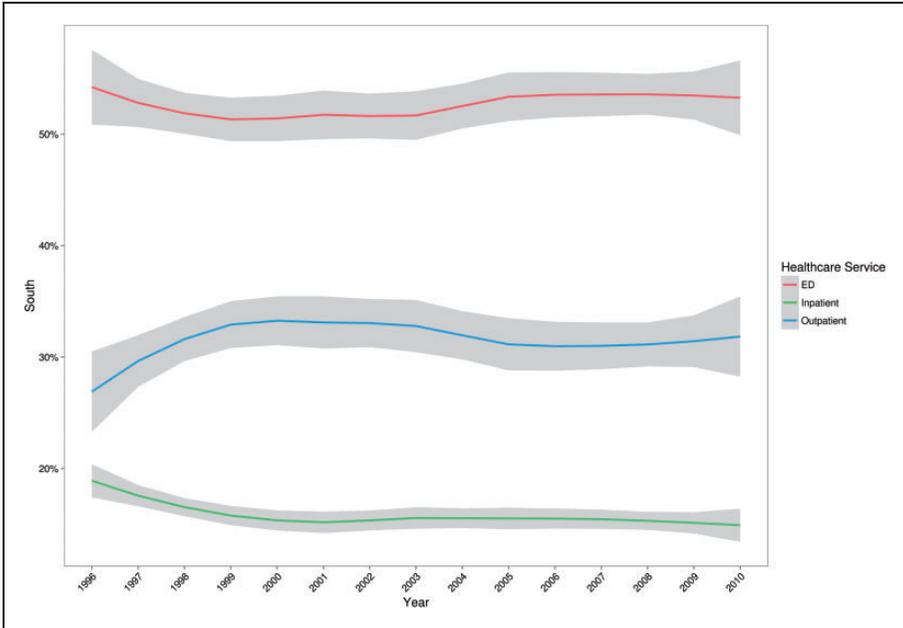


Figure 13. Patterns in the use of EDs, outpatient resources, and inpatient facilities by people who live in southern states. ED, emergency department.

### Results by Geographic Region

Comparison of the percentages of visits across different geographic region revealed that ED utilization rates in southern and western states were 54.0% and 56.3%, respectively (Figures 13 and 14). Patients in these regions consistently made more use of EDs than outpatient clinics or inpatient facilities throughout the study period. In contrast, in the northeast region, ED use was surpassed by outpatient care throughout the study period (Figure 15). In 2010, EDs accounted for 39.5% of all visits, and outpatient and inpatient resources for 47.3% and 13.1%, respectively. Metropolitan areas showed an increasing trend in the ED use, shifting from 53.5% to 56.1% over the years of interest (Figure 16).

### Discussion

To the best of our knowledge, this is the first study evaluating the contribution of EDs to the provision of health care in the United States. We found that, between 1996 and 2010, the number of EDs visits increased by 43.7%, contributing to an average 47.7% of the total number of medical care contacts in the

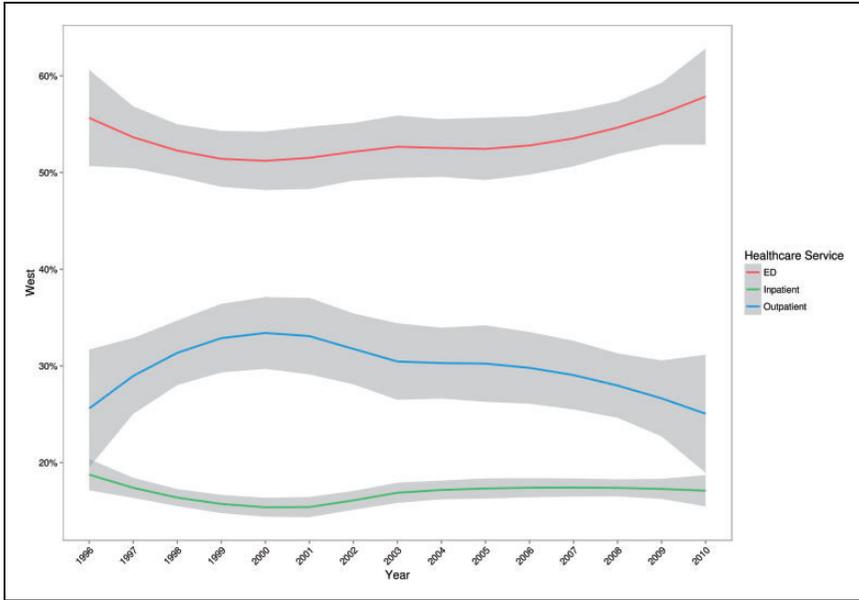


Figure 14. Patterns in the use of EDs, outpatient resources, and inpatient facilities by people who live in western states. ED, emergency department.

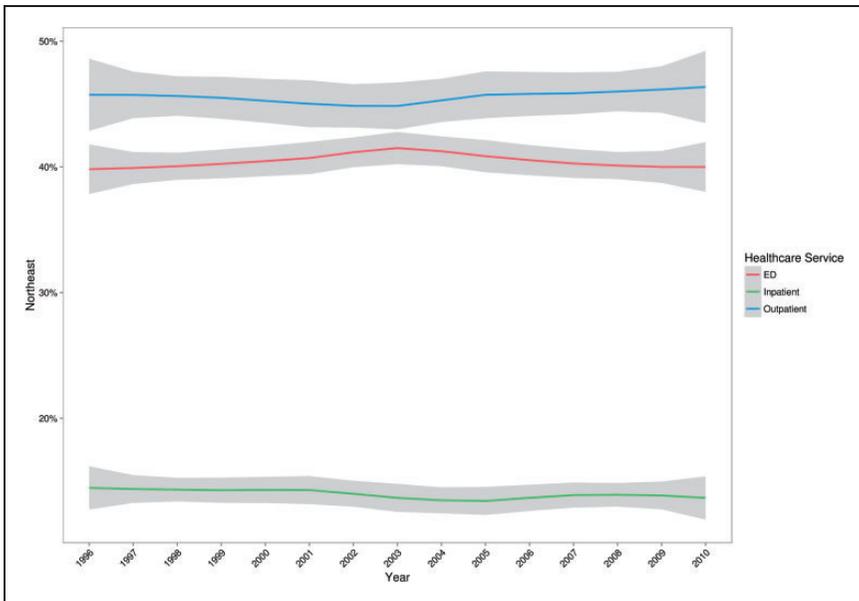


Figure 15. Patterns in the use of EDs, outpatient resources, and inpatient facilities by people who live in the northeastern United States. ED, emergency department.

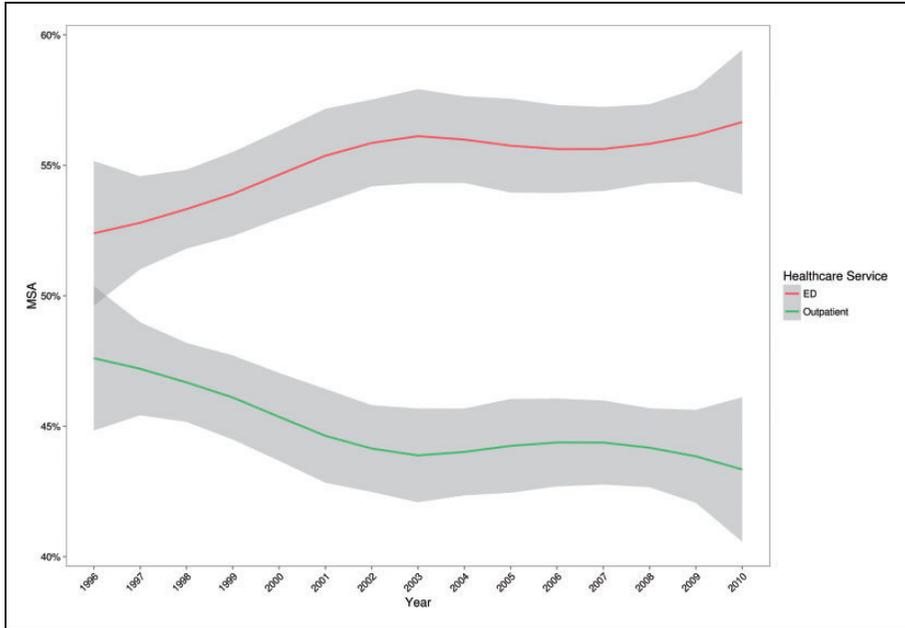


Figure 16. Patterns in the use of EDs and outpatient resources by people who live in metropolitan statistical areas

United States. This proportion increased steadily over our 14-year study period, at a rate higher than expected, considering that the U.S. population increased 17% over the same period.<sup>18</sup>

We found that the following groups accounted for increasing percentages of the ED population: black people, Medicare and Medicaid beneficiaries, residents of the southern and western geographic regions, and women. These findings point to increasing use by vulnerable populations, which is no surprise since socioeconomic and racial inequalities create barriers in access to health care services.<sup>19,20</sup> These barriers include inadequate health insurance coverage, psychosocial impairment, increased severity of health problems, as well as educational, linguistic, and cultural issues.<sup>21</sup> In this context, EDs have a gap-filling role for flaws in other levels of the health care system, being one of the only health care resources always available to individuals in need.<sup>22-24</sup> A number of patients come to EDs for medical evaluation: their reasons include having access to a complete diagnostic workup within a few hours and the unavailability of office-based physicians after hours.<sup>6,25</sup>

Our findings have direct implications to population health discussions. First, emergency departments play a significant role in population health as a component of health care utilization. Second, our study evaluated utilization patterns

across several strata within the United States, approaching population health broadly to best understand this contribution's impact. Third, the stratification of our results is important as it demonstrated that specific subgroups utilize emergency care more frequently. Finally, the results may correlate with access to care challenges.

The use of emergency care resources for nonemergency cases is a controversial topic. The argument has been made that EDs should not be expected to cover for deficiencies in inpatient and outpatient resources<sup>26,27</sup> or for a lack of prevention strategies. This position is based on economics rather than patients' needs. Admittedly, this utilization pattern lowers cost-effectiveness, as emergency care is expensive, with its sophisticated equipment, specialized staff, and readiness for any emergency at any time.<sup>6,28</sup> Moreover, patients with non-emergent conditions contribute to ED overcrowding, lowering the quality of care that can be provided.<sup>29</sup> However, considering the volume of patients who seek care in EDs, we have the responsibility and opportunity to consider how to better accommodate people with non-urgent conditions, including a patient-centered approach to emergency medicine disposition decisions that are integrated with outpatient resources.

Controversies remain on how to deal with these complex issues. Restricting EDs to patients classified as having critical illness does not seem a feasible or humanitarian option, as many individuals would not be able to find care elsewhere.<sup>30</sup> In addition, many people do not have the knowledge to determine which symptoms indicate an emergency. Importantly, EDs have a daily role in supporting patients and their providers' decisions in difficult cases, even when there is no immediate threat to life. In these cases, utilizing the ED as a coordinated care center may reduce the number of unnecessary hospitalizations.<sup>23</sup> Restricting patient access to EDs would likely decrease population health in general.

Our study has several limitations. First, because the NHDS and NHAMCS datasets were published before the Affordable Care Act was enacted, we cannot comment on how that legislation might have affected health care utilization. This limitation should be examined as new editions of the datasets become available. Second, we do not have granular additional information on the geographic distribution of these disparities as detailed geographic data pose a privacy risk and therefore are not released. Third, our study found that black people accounted for increasing percentages of the ED visits, which likely represents a mix of influence by unmeasured confounders and true effects. Fourth, the NHDS dataset does not contain information on ethnicity, which prevented us from adding this variable to our analysis.<sup>16</sup> Lastly, and perhaps more importantly, we do not have direct estimates on how the provision of health care might have affected population health. This evaluation relies on an established proxy for a component of population health, health care utilization, and does not account for other factors of health.

In conclusion, EDs are a major source of medical care in the United States, especially for vulnerable populations, and this contribution increased over the study period. Improving the understanding of a population's health needs, including the value of emergency departments to individuals, would prove beneficial.

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**Brendan Carr, MD, MA, MS**, is associate dean of Healthcare Delivery Innovation at Thomas Jefferson University. He completed his residency in emergency medicine and his fellowship in trauma and surgical critical care at the University of Pennsylvania. Following clinical training, he entered the Robert Wood Johnson Foundation's Clinical Scholars Program, where he received formal training in research methods and a Master of Science degree in health policy research. His research focuses on understanding how the organization of emergency care impacts outcomes in unplanned critical illness. He has studied outcomes and delivery systems for trauma, stroke, cardiac arrest, and sepsis.

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**Brian Browne, MD, MS**, founding chair of the Department of Emergency Medicine at the University of Maryland School of Medicine, is an expert in the administration and operation of fiscally sound emergency medicine networks. His accomplished career in emergency medicine has paralleled the growth and maturation of the specialty. As one of the first physicians in the United States to complete residency training in emergency care, he was recruited to the University of Maryland Medical Center in 1985 to create and lead a new emergency medicine program. That program has become one of the most respected in the world, renowned for its leading-edge clinical services and its educational programs for medical students, residents, and fellows.