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Sarcoidosis-associated Hospitalizations in the United States, 2002 to 2012

To the Editor:

Sarcoidosis is a multisystem granulomatous disease that most often affects the lungs and is characterized by noncaseating granulomas. Pathogenesis is believed to result from an abnormal cell-mediated immune response to an unknown stimulant or antigen, typically in genetically susceptible individuals (1). The highest incidence has been observed among African Americans (2); however, the national burden of sarcoidosis in the United States has not been well described, including the regional variation among white and black racial groups. In this study, we analyzed sarcoidosis-associated (SA) hospitalizations to obtain regional race- and sex-specific estimates and, specifically, to examine the black–white disparity within regions for both men and women.

Although the racial disparity in sarcoidosis incidence has been well described (2–4), the consistency of this differential across regions among both men and women has not been examined. Preliminary results from this study were presented at the American Thoracic Society conference, May 13 to 18, 2016 in San Francisco, California.

Methods

Study population. We extracted discharge (billing) data with SA hospitalizations for the period 2002 to 2012 from the State Inpatient Databases maintained by the U.S. Agency for Healthcare Research and Quality through the Healthcare Cost and Utilization Project (5). The State Inpatient Databases include 97% of all community hospital inpatient discharges, with 48 states currently participating (5). Of these states, 18 provided continuous reporting of race level throughout the study period and had at least 10 SA claims within black/white strata; these states represented 60% of the total U.S. population in 2012 (6). We extracted claims where the International Classification of Diseases, ninth Revision, Clinical Modification code for sarcoidosis (135.0) was listed as the discharge code in
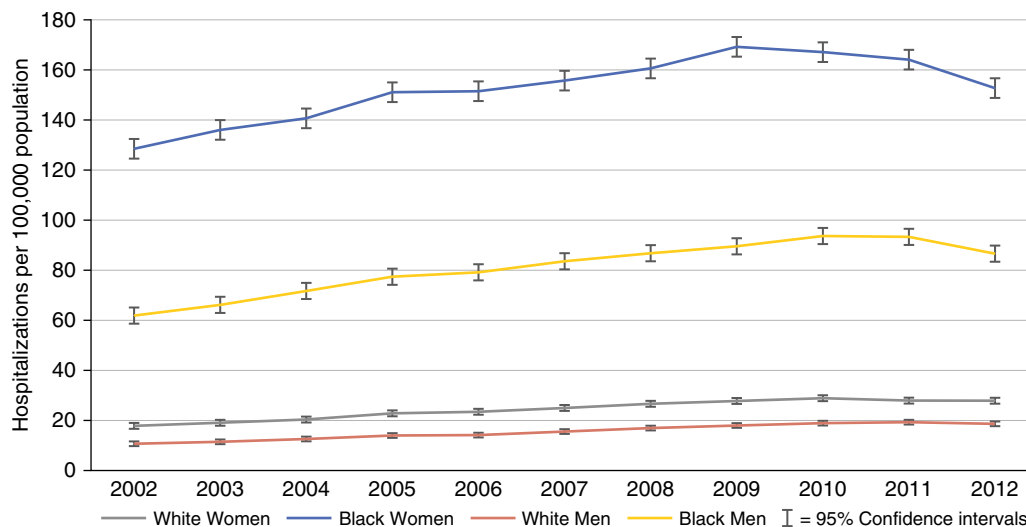
Figure 1. Sarcoidosis-associated hospitalizations by race, sex, and year, 2002 to 2012.

the primary or secondary diagnostic fields. Because of small cell sizes (<10 SA hospitalizations), SA hospitalizations among persons aged younger than 20 years and where race was not listed as black or white were excluded. States were grouped into the following census regions for analysis: Midwest (MI, IA, KS, MO, WI), Northeast (NY, NJ, CT, MA), South (SC, GA, FL, MD, TN, TX), and West (AZ, CA, CO).

Data analysis. U.S. census data were used to estimate the regional populations by age group, sex, and race/ethnicity during the study period. Regional rates were age adjusted using the 2010 U.S. census population as the standard, excluding the population aged younger than 20 years.

Results

From 2002 through 2012, 376,947 SA hospitalizations were identified, including 200,438 (53%) among blacks and 176,509 (47%) among whites. The annual hospitalization rate remained

relatively stable across all groups (Figure 1). Among both black men and women, the peak hospitalization rate occurred among those aged 40 to 64 years, with a rate of 238/100,000 (95% confidence interval [CI], 233–243) for black women and 123/100,000 (95% CI, 119–127) among black men. In contrast, for whites, the highest rates were among those aged 65 years or older: 43/100,000 (95% CI, 42–45) among women and 25/100,000 (95% CI, 24–26) among men (Figure 2).

After stratifying by region and racial group, the highest average annual age-adjusted hospitalization rate was observed among black women in the Midwest (167/100,000; 95% CI, 166–169) and Northeast (133/100,000; 95% CI, 132–133). Among black men, rates were also highest in the Midwest (8/100,000; 95% CI, 84–85) and Northeast (85/100,000; 95% CI, 84–86), with rates nearly identical to each other in those two regions. Across all regions, black women had a seven- to ninefold increased risk of SA hospitalizations compared with white women, and black men had a five- to eightfold increased risk compared with white men (Figure 3).

Discussion

In this large, nationally representative sample of SA hospitalizations, we found a consistent and marked racial disparity in SA hospitalizations across all four regions of the United States. The black–white racial disparity was of similar magnitude across regions. Although prior studies have described rates separately by racial group and region in a national sample of women (4) and by race and region separately (3), these studies did not present rates by racial groups within regions. Environmental risk factors in the home and workplace have been identified, including agriculture exposures and microbial bioaerosols (7); although race may serve as a proxy for differences in home or occupational environmental exposures, the similar magnitude of racial differences in sarcoidosis risk across regions suggests that the contributors to this difference are likely
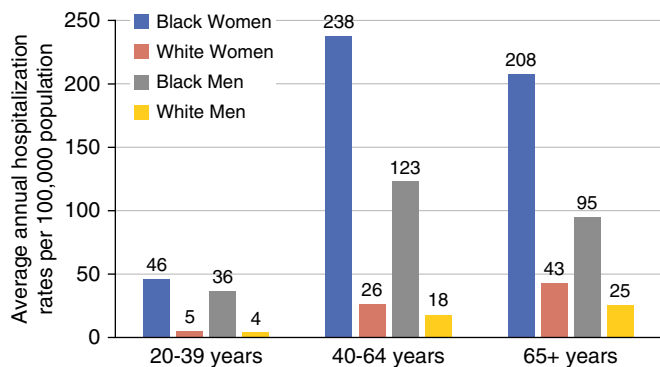

Figure 2. Average annual sarcoidosis-associated hospitalizations by age, race, and sex, 2002 to 2012.
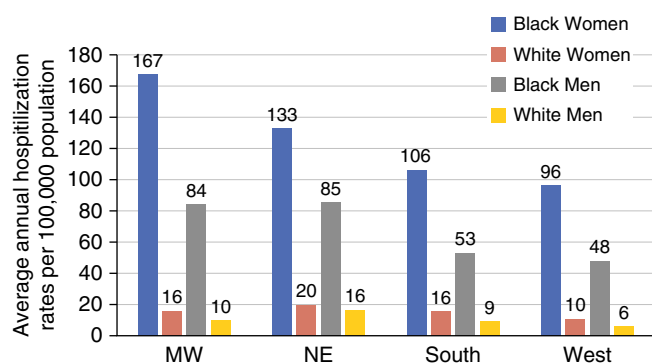
Figure 3. Average annual age-adjusted sarcoidosis-associated hospitalizations by race/ethnicity and region. MW = Midwest; NE = Northeast.

consistent across regions and include genetic ancestry. Environmental and occupational differences vary widely across the regions of the United States. Twin studies and genome-wide association studies have highlighted the role of genetic susceptibility in the risk of disease, including candidate genes specific to African Americans (8). A limitation of this study is that we could not assess the degree to which racial disparities in hospitalizations were related to differences in severity of disease by race.

Differences in sarcoidosis rates by geographic region remain poorly understood. A study conducted among World War II servicemen found the highest rates among African Americans in the Southeastern United States, with the highest risk among residents in areas with specific soil types and rural areas with low population density (9). A recent large, national multicenter case–control study identified several environmental risks, including occupational exposures to insecticides and work areas with musty odors (7). A single-site study found a significant risk of certain "rurally linked" environmental exposures, including wood-burning stoves and seasonal use of indoor fireplaces (10). Sarcoidosis has multiple etiologies, including mycobacteria and other microbes as well as other environmental triggers (7, 8). Occupational and urbanization patterns have changed substantially in the United States since the turn of the century, with a 96% decline in farming and a 64% decline in manual laborers (11). Regional and race-specific disease patterns have likely shifted as a result of changing occupational exposures and other urbanization patterns. In summary, we demonstrate racial disparities for both men and women across regions of the United States, highlighting the importance of both host and environmental factors to disease etiology. Although the black–white disparity in sarcoidosis incidence and prevalence has been well described, the consistency of this disparity across the widely disparate regions of the United States has not.

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Lung Cancer Screening in a Safety-Net Hospital: Implications of Screening a Real-World Population versus the National Lung Screening Trial

To the Editor:

The National Lung Screening Trial (NLST) demonstrated potential for reduction in lung cancer mortality with yearly low-dose computed tomography (LDCT) imaging of high-risk smokers, with relatively low incidence of complications or adverse events (1). However, variations in patient characteristics of those undergoing screening in real-world settings have the potential to significantly alter the balance of benefits and harms related to LDCT screening (2–4). In this study, we compare demographic characteristics and comorbidities of patients who underwent LDCT screening in an academic safety-net hospital to those of NLST participants.

Methods

We conducted a retrospective study to characterize patients who underwent LDCT screening at Boston Medical Center (BMC) from March 2015 through July 2017, identified from the comprehensive BMC LDCT screening registry. This study was approved by the BMC Institutional Review Board (#H-35758).

We compared demographic characteristics and comorbidities of the BMC cohort with those of NLST participants enrolled in the LDCT arm. Characteristics of patients were identified at the time of the first LDCT in both cohorts. NLST data were obtained from the National Cancer Institute Cancer Data Access System; baseline comorbidity data were collected at the time of NLST enrollment by participant self-report. We selected comorbidities available in the NLST data set that had either a prevalence of at least 4.0% or clinical relevance (history of lung cancer). BMC cohort data were obtained from the BMC Clinical Data Warehouse using *International Classification of Diseases, 10th Revision* (ICD-10) codes and supplemented with manual chart abstraction. In both cohorts, chronic obstructive pulmonary disease (COPD) was defined as having a history of chronic

bronchitis, emphysema, or unspecified COPD. In the BMC cohort, heart disease was defined as having a history of cardiovascular disease, myocardial infarction, or congestive heart disease.

We used chi-square analysis, the Mann-Whitney test, and Fisher exact test, as appropriate, to compare characteristics of the two cohorts. The Charlson comorbidity score was calculated for BMC patients using previously defined ICD-10 coding algorithms (5) but could not be calculated for NLST participants, given limited available comorbidity data. Given there were few minority participants in the NLST, we performed a sensitivity analysis restricted to white patients in the two cohorts using a similar analytic approach.

Results

We compared 1,203 patients who underwent LDCT screening at BMC against 26,310 patients in the NLST who completed the first round of LDCT screening. Table 1 shows characteristics of the BMC versus NLST cohorts.

The demographics of patients who underwent LDCT screening at BMC were reflective of the patient population who receive care at this urban safety-net hospital (6). Patients screened at BMC were older, had less-advanced educational backgrounds, and included more racial and ethnic minorities than those screened in the NLST. Although BMC patients had a lower mean number of total smoking pack-years, significantly more patients were current smokers at the time of screening. The BMC cohort had a higher frequency of all measured comorbidities ($P < 0.01$) and higher frequency of oxygen use ($P < 0.01$) when compared with the NLST cohort. Twice as many BMC patients as NLST participants had two or more of the measured comorbidities (64.6% vs. 29.5%; $P < 0.01$), and 201 (16.7%) BMC patients had a Charlson score of 4 or greater (poor health corresponding with life expectancy < 10 yr). In our sensitivity analysis, similar results were found when comparing only white patients in the two cohorts.

Discussion

We report characteristics of patients who have undergone LDCT screening at an urban academic safety-net hospital. Our program screened more than 1,200 patients through the first 28 months after program inception, with a patient population consisting of nearly 40% minorities. We have been able to include a diverse patient population by providing outreach to primary care clinicians at our own safety-net hospital and associated community health centers, by promoting our LDCT screening program at community health fairs, and by employing a patient navigator to overcome barriers to LDCT screening access.

Although the volume and diversity of patients screened in our program is promising, our study demonstrates significant