

Racial Disparities in Age at Preventable Hospitalization Among U.S. Adults

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Background: Similar to the well-documented racial inequities in health status, disease burden, healthcare access, and hospitalization, studies have generally found higher rates of hospitalization resulting from ambulatory care-sensitive conditions for blacks compared to whites. Beyond identifying disparity in rates of disease or risks of hospitalization, identifying disparity in age at hospitalization may provide deeper insight into the social and economic effects of disparities on individuals, families, and communities.

Purpose: The objective of this paper is to evaluate potential racial disparities in age of preventable hospitalizations as measured by ambulatory care-sensitive conditions.

Methods: Differences in mean age at hospitalization for ambulatory care-sensitive conditions were evaluated in a nationally representative sample of 6815 hospital discharges using the 2005 National Hospital Discharge Survey. Linear regression using robust SE procedures was used to evaluate differences among nine chronic and three acute conditions. Analyses were conducted in 2008.

Results: After adjustment for sociodemographic characteristics, blacks were hospitalized ≥ 5 years earlier than whites across all conditions combined and for chronic and acute conditions separately. The largest differences were seen for uncontrolled diabetes (adjusted difference = -12.0 years) and bacterial pneumonia (adjusted difference = -7.5 years).

Conclusions: Racial disparities in age at preventable hospitalization exist across a spectrum of conditions. This difference in age at hospitalization places an undue burden on individuals, families, and society with long-term health and financial sequelae. Promoting equity in disease prevention, management, and treatment should be a priority of any healthcare reform efforts.

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Background

From preterm birth to premature death, severe and persistent racial inequities in health status, disease burden, healthcare access, and hospitalizations are well documented in the U.S. African Americans have higher rates of morbidity and mortality for nearly all conditions compared to non-Hispanic whites, and they

are increasingly less likely to have health insurance and receive job-based health coverage.¹⁻⁵ In addition, African Americans have less access to preventive and primary care services and lower rates of screening, diagnostic tests, and referrals to specialists.⁶⁻⁸ Moreover, racial and ethnic minorities of the same SES and insurance status as their white counterparts experience a lower quality of health services and are less likely to receive even routine medical procedures.^{9,10} Prior studies¹¹⁻¹³ also have documented higher rates of emergency department use and hospitalization among people of color.

Ambulatory care-sensitive conditions are those conditions for which timely ambulatory care may reduce the need for hospitalization; thus they are often referred to as "preventable hospitalizations."¹⁴ Access to and use of ambulatory care can reduce the risk of hospitalization in several ways: (1) prevent disease through immunization,

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nutrition, or behavioral interventions; (2) treat conditions that can lead to rapid-onset problems, such as bacterial pneumonia; and (3) manage chronic conditions to prevent an adverse disease trajectory (e.g., more frequent and severe symptoms or complications).⁸ Therefore, beginning with a 1993 IOM report,¹⁵ ambulatory care-sensitive conditions have been used as an indicator of access to and performance of primary care.

Several studies^{8,13,16–23} have examined patterns of hospitalization resulting from ambulatory care-sensitive conditions by race/ethnicity, generally finding higher rates of hospitalization for blacks compared to whites. Prior research has been limited to particular age groups (e.g., pediatrics, geriatrics) or has controlled for age in analyses, thereby not directly examining potential racial differences in age at hospitalization. One study⁸ found that risk of hospitalization for all ambulatory care-sensitive conditions combined increased by 3.7% for each additional year of age for African-American and Hispanic women but only by 1.7% for non-Hispanic whites.

Beyond identifying disparity in rates of disease or risks of hospitalization, identifying disparity in age at hospitalization may provide deeper insight into the social and economic consequences of disparities on individuals, families, and communities. The primary objective of this study is to identify potential disparities by race in mean age of preventable hospitalizations as measured by ambulatory care-sensitive conditions, using the National Hospital Discharge Survey. It is hypothesized that, on average, blacks will have a younger age at hospitalization than whites overall and across most ambulatory care-sensitive conditions, even after controlling for various sociodemographic characteristics. Racial disparities in age at hospitalization are hypothesized to be similar for acute and chronic conditions.

Methods

Data Collection and Sampling

Data were obtained from the public-use data files of the 2005 National Hospital Discharge Survey, the most recent year for which data were available at the time of analysis (December 2008). This annual survey—which collects medical and demographic information from inpatient discharge records using a national probability sample of nonfederal, short-stay hospitals—included 501 hospitals; of these, 28 were deemed ineligible. Of the 473 eligible hospitals, 444 hospitals responded (94%).²⁴

The survey is conducted using a modified, three-stage design. First, sampling units consist of either hospitals or geographic areas across 50 states and the District of Columbia. Second, within sampled geographic areas, additional hospitals were selected. Third, discharges were selected

within sampled hospitals using systematic random sampling.²⁴ Public-use data files provide probability weights that allow researchers to inflate this sample to national estimates. For this analysis, discharges were excluded if they concerned individuals who were transferred from another institution; hospitalized for pregnancy, childbirth, or puerperium; or were newborn or neonate.

Measures

For the National Hospital Discharge Survey, diagnoses were obtained for all inpatients at discharge. Specifically, up to seven diagnoses and four procedures were documented for each discharge using ICD-9-CM codes. Principal diagnosis was then established after determining the condition that was chiefly responsible for occasioning the admission of the patient to the hospital for care.²⁴ For the current analysis, only principal diagnoses were used. Notably, the discharges do not necessarily refer to first admissions for ambulatory care-sensitive conditions or to unique individuals. As a result, these should be understood as occasions of care. Diagnoses were categorized according to methodology of the Agency for Healthcare Research and Quality's prevention quality indicators for adults—or ambulatory care-sensitive conditions.²⁵

Chronic conditions. Individuals classified as having been discharged for the following conditions were classified as hospitalized due to a chronic ambulatory care-sensitive condition: (1) adult asthma; (2) chronic obstructive pulmonary disease (COPD); (3) angina; (4) hypertension; (5) congestive heart failure; (6) diabetes with short-term complication (i.e., ketoacidosis, hyperosmolarity, coma); (7) diabetes with long-term complication (i.e., renal, eye, neurologic, circulatory, or complications not otherwise specified); (8) uncontrolled diabetes (without mention of short- or long-term complications); and (9) lower-extremity amputation with a diagnosis code of diabetes and no diagnosis code of trauma. For those with a primary code of angina, hypertension, or congestive heart failure, discharges with a cardiac procedure code were excluded. Patients with these diagnoses may be admitted electively for a cardiac procedure and would be reported as principal diagnosis even though the admission did not reflect long-term outpatient management.

Acute conditions. Individuals discharged for the following conditions were classified as hospitalized because of an acute ambulatory care-sensitive condition: (1) dehydration, (2) urinary tract infection, and (3) bacterial pneumonia (discharges with diagnosis codes for sickle cell anemia/HB-S disease in any other diagnosis listing were excluded). Perforated appendix is often considered an ambulatory care-sensitive condition; however, given low incidence (race-specific $n < 30$) and its lack of comparability to other conditions, it was excluded from this analysis.

Sociodemographic Characteristics

Sociodemographic characteristics were determined by reported status on discharge records. Age at last birthday, gender, and race were reported on discharge forms. Analyses were restricted to blacks and whites, regardless of ethnicity, because Hispanic ethnicity was not included in the data set and other racial groups made up less than 1% of the sampled population. The term *black* was used following the primary survey label “black/African American,” indicating that other groups, regardless of nationality, may be categorized (e.g., Caribbean Americans, foreign-born immigrants). Marital status was classified as married; single (never married); widowed; divorced/separated; or not stated, per patient self-report. Expected source of patient payment was categorized into public insurance (i.e., worker’s compensation, Medicare, Medicaid, other government payments); private insurance (i.e., Blue Cross/Blue Shield, HMO/PPO, other private or commercial insurance); self-pay; or other (e.g., no charge, not stated). This was used as a proxy for SES, because no income or educational attainment data were available. Finally, hospital region was categorized in geographic regions corresponding to those used by the U.S. Census—Northeast, Midwest, South, and West—to control for regional differences in hospitalization practices or policies.

Sample Derivation

Overall, 65,850 hospital discharges were reported in the 2005 National Hospital Discharge Survey. Among all discharges reported, 13.8% of the hospitalizations were for one of the specified ambulatory care-sensitive conditions in patients aged ≥ 18 years ($n=9092$). Among those with a relevant condition, 24.5% were excluded because of a missing race designation ($n=2230$) and 0.5% were excluded because they had a race designation other than black or white ($n=47$). The National Hospital Discharge Survey²⁶ indicates that some hospitals submit data using an automated method that involves purchasing data collected for other purposes and therefore may not include race. In addition, many Hispanics would not identify with a specific race.²⁶ Therefore, 6815 of reported hospital discharges were included for analysis.

Data Analyses

Mean age at hospitalization, weighted to allow inflation to national estimates, was examined for each condition described above and stratified by race. Of the 12 ambulatory care-sensitive conditions assessed, two (angina and lower-extremity amputation) had unweighted race-specific counts of hospitalizations < 30 and were considered unreliable.²⁴ Therefore, these conditions were not examined independently but were included in analyses examining racial differences across all conditions combined and chronic conditions as a group.

To test for differences by race, race was regressed on age at hospitalization for each ambulatory care-sensitive condition separately. These analyses were then repeated, simulta-

neously adjusting for patient gender, marital status, expected source of payment for hospitalization, and hospital region. It is important to note that the underlying prevalence of the ambulatory care-sensitive conditions in blacks and whites was not adjusted for, as has been advised when assessing a disparity in risk or rate of hospitalization to ensure that the observed disparity in rates of hospitalization was not simply due to a disparity in prevalence of disease.¹⁹ Because this analysis examines mean age at hospitalization, regardless of differences in underlying prevalence of disease, being hospitalized at an earlier age would be considered “premature.” Both unadjusted and adjusted mean age at hospitalization for blacks and whites, differences in the mean ages, and 95% CIs are reported. Significance was determined for differences where two-sided $p < 0.05$.

As noted previously, individual patients were clustered into hospital- and region-sampling units and thus are not completely independent. Although it would have been appropriate to use generalized linear models to account for this cluster effect, the variable containing primary sampling unit information was not available in public-use files. Using ordinary least squares regression and, as a result, not accounting for the cluster effects may lead to an underestimation of the SEs and an overestimation of the significance. To reduce this bias, robust SE procedures in SAS were used to obtain more conservative SEs than those generated from standard regression procedures by accounting for dependence among individuals.^{27,28}

Results

Racial Differences in Ambulatory Care-Sensitive Conditions

Table 1 provides comparisons of demographic characteristics of those discharged for an ambulatory care-sensitive condition by race, using weighted frequencies. Among the 6815 discharges for ambulatory care-sensitive conditions, 16.4% were black and 83.6% were white. Women represent approximately 60% of all discharged cases among both blacks and whites. However, blacks and whites differed significantly by other sociodemographic characteristics. Specifically, blacks were less likely to be aged ≥ 65 years at time of hospitalization compared to whites (43.6% vs 70.1%, respectively) and less likely than whites to be married (19.7% vs 31.8%, respectively). The majority of both blacks and whites expected to pay for hospital services through public insurance (72.5% vs 77.3%, respectively); however, this was significantly lower among blacks, whereas self-pay and “other” were slightly higher. Reflecting national demography, blacks discharged for ambulatory care-sensitive conditions were more likely than whites to live in the Northeast and South and less likely to live in the Midwest.

Table 2 provides regression results. Across all ambulatory care-sensitive conditions, weighted mean age at hos-

Table 1. Demographic characteristics of discharges for at least one ambulatory care-sensitive condition ($n=6815$), by race^a

Variable (n)	Black (n=1404), % (n)	White (n=5411), % (n)
Age (years)*		
18–44 (742)	17.0 (263)	8.4 (479)
45–64 (1741)	39.4 (532)	21.5 (1209)
≥65 (4332)	43.6 (609)	70.1 (3723)
Gender		
Male (2810)	41.2 (601)	39.9 (2209)
Female (4005)	58.8 (803)	60.1 (3202)
Marital status*		
Married (1634)	19.7 (204)	31.8 (1430)
Single (790)	30.4 (318)	9.4 (472)
Widowed (1176)	21.3 (174)	22.5 (1002)
Divorced/separated (403)	8.2 (85)	6.2 (318)
Not stated (2812)	20.4 (623)	30.0 (2189)
Expected source of payment*		
Public (5187)	72.5 (1013)	77.3 (4174)
Private (1220)	16.6 (241)	16.7 (979)
Self-pay (227)	6.8 (88)	4.1 (139)
Other ^b (181)	4.1 (62)	1.9 (119)
Region*		
Northeast (4231)	41.2 (1036)	33.3 (3195)
Midwest (740)	5.1 (36)	29.6 (704)
South (1721)	52.3 (318)	33.6 (1403)
West (123)	1.4 (14)	3.5 (109)

^a n 's are unweighted frequencies and percentages are weighted using National Hospital Discharge Survey probability weights.

^bOther includes other ($n=75$), no charge ($n=51$), and not stated ($n=55$).

* $p<0.01$ using Rao–Scott χ^2 test for clustered data.

pitalization was 69.2 years. Unadjusted results demonstrate that, on average, blacks were hospitalized 9 years earlier than whites (61.7 vs 70.9, $p<0.001$) for all conditions combined. For chronic ambulatory care-sensitive conditions, blacks were hospitalized an average of 9.7 years earlier than whites (59.3 vs 69.0, $p<0.001$). For acute ambulatory care-sensitive conditions, blacks were hospitalized 7.0 years earlier than whites (66.4 vs 73.4, $p<0.001$). Mean age at hospitalization was significantly different for blacks and whites for five of the ten ambula-

tory care-sensitive conditions observed (i.e., COPD, congestive heart failure, diabetes with long-term complications, hypertension, and bacterial pneumonia), and it was marginally significant ($p<0.10$) for two other conditions (i.e., adult asthma, uncontrolled diabetes).

Although differences were attenuated, Table 2 demonstrates that the effect of race remained after adjusting for gender, marital status, expected source of payment, and hospital region, indicating that the observed racial disparities are not entirely explained by differences in these sociodemographic characteristics. For all conditions examined, blacks were hospitalized at a younger age than whites: from 2.4 to 12.0 years earlier. Considering these adjusted values, for chronic ambulatory care-sensitive conditions, blacks were hospitalized an average of 5.5 years earlier than whites (55.1 vs 60.5, $p<0.001$). For acute ambulatory care-sensitive conditions, blacks were hospitalized 5.1 years earlier than whites (57.4 vs 62.5, $p<0.001$). The largest disparities were documented for ambulatory care-sensitive hospitalizations resulting from uncontrolled diabetes (adjusted difference = -12.0 years, $p<0.001$) and bacterial pneumonia (adjusted difference = -7.5 , $p<0.001$). Significant disparities in age at hospitalization were also observed for COPD, hypertension, congestive heart failure, and dehydration, with blacks significantly younger than whites at age of hospitalization. Adjustment for gender, marital status, expected source of payment, and hospital region eliminated the disparity in age at hospitalization for diabetes with long-term complications, indicating that racial disparities reflected underlying sociodemographic differences for this condition.

Post hoc analyses of age at hospitalization by U.S. population age distribution. Although mean age at hospitalization is a useful measure because of its ease of interpretation, it does not account for differences in the underlying population. Comparisons of age distributions for blacks and whites in the U.S. using 2005 midyear census data indicated that the groups differ in age distribution, with blacks younger than whites.^{29,30} Post hoc analyses of age-specific discharge rates for each ambulatory care-sensitive condition were thus conducted to ensure that the racial differences in mean age at hospitalizations were not simply an artifact of racial differences in the underlying age distribution. If the observed disparities in age at hospitalization are valid, it would be expected that rates in the younger age groups would be higher for blacks compared to whites and that rate ratios would be larger in the younger age groups compared to older age groups. In fact, age-specific discharge rates for each ambulatory care-sensitive condition demonstrated that blacks indeed had significantly higher hospitaliza-

Table 2. Mean age at hospitalization for ambulatory care–sensitive conditions, NHDS, 2005

Ambulatory care–sensitive conditions ^b (n) ^c	Unadjusted			Adjusted ^a		
	Black	White	Difference (95% CI)	Black	White	Difference (95% CI)
Overall* (6815)	61.7	70.9	–9.2 (–11.1, –7.4)	55.7	61.2	–5.5 (–7.1, –4.0)
Chronic conditions* (4162)	59.3	69.0	–9.7 (–12.0, –7.3)	55.1	60.5	–5.5 (–7.5, –3.5)
Adult asthma (477)	50.1	55.7	–5.5 (–11.7, 0.7)	48.9	51.3	–2.4 (–7.3, 2.5)
Chronic obstructive pulmonary disease* (805)	63.0	69.5	–6.5 (–10.1, –2.8)	56.7	61.1	–4.4 (–8.3, –0.6)
Hypertension* (495)	56.9	65.9	–8.9 (–13.1, –4.7)	56.1	62.4	–6.3 (–9.6, –2.9)
Congestive heart failure* (1460)	67.9	77.0	–9.2 (–13.4, –5.0)	66.1	71.1	–5.0 (–8.2, –1.7)
Diabetes short-term complication (159)	38.7	45.2	–6.4 (–14.8, 1.9)	42.7	46.6	–3.9 (–11.1, 3.4)
Diabetes long-term complication (464)	58.1	63.2	–5.2 (–10.0, –0.4)	52.3	54.8	–2.5 (–6.7, 1.7)
Diabetes uncontrolled* (109)	52.4	62.8	–10.4 (–21.5, 0.6)	46.2	58.2	–12.0 (–18.8, –5.1)
Acute conditions* (2653)	66.4	73.4	–7.0 (–10.0, –4.0)	57.4	62.5	–5.1 (–7.4, –2.7)
Dehydration* (549)	68.1	69.0	–0.9 (–7.5, 5.7)	52.3	57.4	–5.2 (–9.3, –1.0)
Urinary tract infection (684)	70.8	74.4	–3.6 (–9.6, 2.4)	59.4	62.0	–2.6 (–7.5, 2.4)
Bacterial pneumonia* (1420)	62.6	74.3	–11.7 (–15.5, –8.0)	57.1	64.5	–7.5 (–10.3, –4.6)

^aAdjusted for gender, marital status, region of hospital, and expected source of payment using NHDS probability weights

^bOf the 12 ambulatory care–sensitive conditions assessed, two (angina and lower-extremity amputation) had race-specific unweighted counts of hospitalizations of less than 30; therefore, these conditions were not examined independently but were included in the analyses examining racial differences across all conditions combined and chronic conditions as a group.

^cThe n's are unweighted frequencies, and mean ages and differences are weighted using NHDS probability weights.

* $p < 0.05$ for adjusted model.

NHDS, National Hospital Discharge Survey

tion rates for all ambulatory care–sensitive conditions in those aged 18–44 years as well as in those aged 45–64 years (data not shown). In addition, rate ratios were larger in the younger age groups (18–44 and 45–64 years) compared to the older age groups (≥ 65 years) for all conditions except dehydration. Therefore, observed race differentials in age at hospitalization are not likely because of differences in the underlying age distributions.

Discussion

Racial differences in age at hospitalization for ambulatory care–sensitive conditions demonstrate that blacks are hospitalized for these conditions prematurely, even after controlling for individual and hospital characteristics likely to influence hospitalizations. Blacks were hospitalized at significantly younger ages than whites for all causes, chronic conditions, acute conditions, and the following conditions: uncontrolled diabetes; bacterial pneumonia; diseases of the circulatory system (congestive heart failure and hypertension); COPD; and dehydration. No racial disparities were detected for asthma, short-term complications of diabetes, or urinary tract infections. Differences in age at hospitaliza-

tion for long-term diabetes complications were attenuated by sociodemographic characteristics.

Beyond identifying disparity in rates of disease or risks of hospitalization, identifying disparity in age at hospitalization provides deeper insight into the social and economic effects of disparities on individuals, families, and communities. Premature hospitalizations resulting from preventable ambulatory care–sensitive conditions result in substantial economic burden to society, with treatment estimated to exceed \$263 billion annually.³¹ Moreover, these costs are dwarfed by secondary costs and long-term sequelae. Families must endure direct costs through rising out-of-pocket expenses and lost days of work.^{32,33} Poor health, particularly that resulting from more severe diseases or disease complications, can lower social status, by limiting a person's ability to work, wages earned, and level of education attained, resulting in lower SES for the family within one to two generations.^{34–37} For example, consider direct and indirect health and economic consequences of hospitalization for uncontrolled diabetes for a black man aged 46 years compared to a white man aged 58 years.

Reducing disparities and promoting equity in health will require challenging systems-level changes. A recent Kaiser Family Foundation brief³⁸ outlined priorities to reduce disparities: (1) increase public/provider awareness of disparities, (2) expand health insurance coverage, (3) improve capacity in underserved areas, and (4) increase the knowledge base of intervention strategies. With the current economic downturn, escalating health-care costs, and persistent systemic disparities, a window of opportunity to make these changes exists.³⁹ Because blacks are disproportionately uninsured and thus have less access to routine care, expanding and enhancing programs such as Medicaid and SCHIP could promote health equity.⁴⁰ Finally, a commitment to prevention could reduce unnecessary hospitalizations across all racial/ethnic groups.

This study has several limitations. The data did not allow a determination of whether these were first or repeat admissions for ambulatory care-sensitive conditions. Using discharge records with incomplete data on SES and comorbid conditions limits the extent to which underlying causes can be disentangled. Primary sampling units are not available in the public-use files of the NHDS; therefore, generalized linear models could not be performed, and robust SEs had to be calculated to account for the dependence of individuals within clusters.^{27,28}

Finally, because data were collected using discharge records, missing data and measurement error may be problematic. One quarter of discharges were missing information on race. A previous review of this data source indicated that the majority of Hispanics did not report a specific race and therefore would be appropriately excluded.^{26,27,41} Of Hispanics who reported race, 90% reported race as white. In addition, because Hispanics in the U.S. are younger on average than whites,⁴² this would likely lead to an underestimation of the noted difference.

This study also has several notable strengths, utilizing data from a representative, national sample of more than 6800 hospital discharges. The focus on ambulatory care-sensitive conditions, which are frequently used measures, can be easily replicated. Moreover, this can serve as a common metric through which changes over time can be documented. This is the first study to examine racial disparities in age at hospitalization for each ambulatory care-sensitive condition separately, thus providing more detailed documentation of observed disparities. Results of this study highlight the impact that younger age at hospitalization may have on the social and economic well-being of individuals and their families, through loss of wages, poorer quality of life, and risk for a greater number of hospitalizations and severity of illness over the life span. Therefore, this focus on ambulatory care-sensitive conditions has important implications for fu-

ture prevention efforts designed to reduce health disparities and promote health equity.

Conclusion

Racial disparities in health persist across a large spectrum of indicators. Future studies should focus on understanding underlying causes of the observed racial disparity in age at hospitalization by assessing differences in access to care, quality of care, underlying conditions, and relevant socioeconomic factors. In addition, studies should aim to further describe the social and economic impact of premature hospitalizations. Premature hospitalization for ambulatory care-sensitive conditions places an undue burden and cost on black individuals and their families as well as on society at large. Although reducing disparities will require challenging system-level changes, the renewed focus on health reform in the U.S. presents new opportunities for prevention and care.

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