Potentially Avoidable Hospitalizations: Inequalities in Rates between US Socioeconomic Groups

A B S T R A C T

Objectives. The National Hospital Discharge Survey (NHDS) was used to evaluate potentially avoidable hospital conditions as an indicator of equity and efficiency in the US health care system.

Methods. With the use of 1990 data from the NHDS, the National Health Interview Survey, and the census, national rates of hospitalization were calculated for avoidable conditions by age, race, median income of zip code, and insurance status.

Results. An estimated 3.1 million hospitalizations were for potentially avoidable conditions. This was 12% of all hospitalizations in 1990 (excluding psychiatric admissions, women with deliveries, and newborns). Rates of potentially avoidable hospitalizations were higher for persons living in middle- and low-income areas than for persons living in high-income areas, and were higher among Blacks than among Whites. These class and racial differences were also found among the privately insured. Differences among income and racial groups for persons aged 65 and over were not significant.

Conclusions. Inequalities in potentially avoidable hospitalizations suggest inequity and inefficiency in the health care delivery system. Avoidable hospital conditions are a useful national indicator to monitor access to care. (*Am J Public Health.* 1997;87:811–816)

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Introduction

Social inequalities in access to health care persist in the US health care delivery system.[1] Lower social classes, minority racial/ethnic groups, and those without health insurance continue to experience barriers to care.[2] Monitoring access for vulnerable populations is of heightened importance during a period of rapid transformation of the health care system and a changing economy.

The lack of timely, appropriate ambulatory care may lead to illnesses that require hospitalizations.[2–4] Hospitalizations for selected conditions have been suggested as indicators of access to care.[5] Communities in which people report poor access to care have higher rates of hospitalizations for chronic conditions that may be preventable.[6] City and state hospital discharge data have been used to demonstrate that potentially avoidable hospitalizations vary by socioeconomic and insurance status.[7,8] Middle and lower classes are less likely to receive preventive services, more likely to experience delays in their care, and less likely to have a regular source of care.[5,9,10] Studies of hospital use in this country and international comparisons of health care delivery systems suggest that better ambulatory care can decrease the need for hospitalization.[11,12] Concerns about the costs of avoidable hospitalizations, both economic and human, have also been raised.[13,14]

This article uses the National Hospital Discharge Survey (NHDS) as a data source for monitoring potentially avoidable hospital conditions on a national basis. US rates of hospitalizations for avoidable conditions are examined for median household income, race, and insurance status groups for 1990. National estimates of potentially avoidable hospitalizations are presented.

Methods

Avoidable Hospital Conditions

Following Weissman et al.,[7] we examined 12 principal or first-listed diagnoses for which hospitalization can often be avoided if ambulatory care is provided in a timely and effective manner (see Table 1). These conditions are narrowly defined. For example, Weissman et al.[7] exclude stroke and pulmonary emboli because they consider the evidence linking primary care to the avoidance of hospitalization for these conditions to be inconclusive. The selected conditions are also avoidable to various degrees. Asthma and congestive heart failure are conditions for which outpatient treatment cannot be expected to prevent hospitalizations in all circumstances. However, conditions due to immunizable infectious diseases (such as measles) should be preventable in all cases.

Data Sources

To estimate the number of discharges for potentially avoidable conditions, we used the NHDS for 1990. The NHDS is a continuous survey conducted by the National Center for Health Statistics that provides national estimates of hospital use.[15] The survey includes patients discharged from nonfederal, short-stay general and specialty hospitals. For 1990, 474

TABLE 1—Number of Avoidable Hospitalizations by Condition,[a] Based on Number of Discharges (in Thousands)

Avoidable Condition and ICD-9-CM Codes	All Ages		Under 15 Years		15–44 Years		45–64 Years		65 Years and Over	
	No.	CI	No.	CI	No.	CI	No.	CI	No.	CI
All avoidable hospitalizations	3105	2897, 3314	439	338, 540	556	514, 597	577	537, 616	1534	1419, 1649
Pneumonia 481–483, 485–486	1017	933, 1101	187	151, 224	138	120, 156	151	134, 168	541	487, 595
Congestive heart failure 402.01, 402.11, 402.91, 428	765	706, 824	4[b]	2, 6	22	17, 27	131	114, 147	609	559, 658
Asthma 493	476	411, 541	169	113, 225	119	104, 134	86	72, 99	102	86, 119
Cellulitis 681, 682	288	261, 315	27	19, 35	94	78, 109	76	64, 88	92	78, 106
Perforated or bleeding ulcer 531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0–533.2, 533.4–533.6	146	129, 164	...[c]		19	14, 24	45	37, 54	81	70, 93
Pyelonephritis 590.0, 590.1, 590.8	127	110, 145	11	6, 16	66	56, 76	24	17, 31	26	18, 35
Diabetes with ketoacidosis or coma 250.1–250.3, 251.0	100	85, 115	11	5, 17	50	39, 61	21	15, 26	18	13, 23
Ruptured appendix 540.0–540.1	67	58, 76	17	13, 21	28	23, 33	11	7, 15	11	7, 15
Malignant hypertension 401.0, 402.0, 403.0, 404.0, 405.0, 437.2	59	48, 71	...[c]		12	8, 16	21	15, 27	26	19, 34
Hypokalemia 276.8	42	34, 50	...[c]		5[b]	3, 8	11	8, 14	26	19, 33
Immunizable conditions 032, 033, 037, 045, 055, 072	16	7, 25	11	3, 19	...[c]		...[c]		...[c]	
Gangrene 785.4	...[c]		...[c]		...[c]		...[c]		...[c]	

Note. ICD-9-CM = *International Classification of Diseases, 9th Revision, Clinical Modifications;* CI = 95% confidence interval.
[a]Data are from the National Hospital Discharge Survey, 1990.
[b]The estimate should be used with caution because it was based on a small number of cases (<60).
[c]The number of cases in the sample was too small (<30) to make a reliable estimate.

participating hospitals submitted approximately 266 000 abstracted medical records, of which 192 734 were used in this study. Records for psychiatric admissions, women with deliveries, and newborns were excluded. There were 23 552 records with potentially avoidable conditions as principal or first-listed diagnoses. The records were weighted to produce national estimates of hospital use. Diagnoses were coded using the *International Classification of Diseases, 9th Revision, Clinical Modifications* (ICD-9-CM).[16]

In addition to discharge diagnosis, the variables from the NHDS used in this study include patient's age, sex, race, length of stay, expected principal source of payment, and zip code of residence. Discharges in the 1990 NHDS came from 15 186 of the more than 29 000 zip codes in the United States. The zip code was missing or invalid on 4% of the NHDS records, but no systematic bias was found among these records by age, race, or sex. Race was not specified on 19% of records in the 1990 NHDS, leading to a substantial underestimate of hospitalizations in analyses by race. Furthermore, race was probably underreported to a greater extent
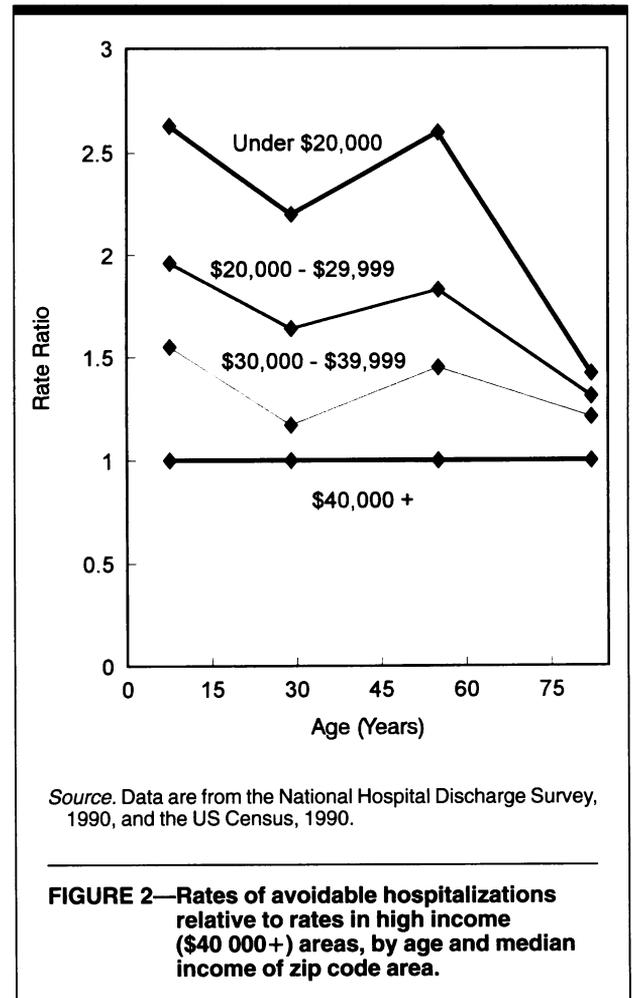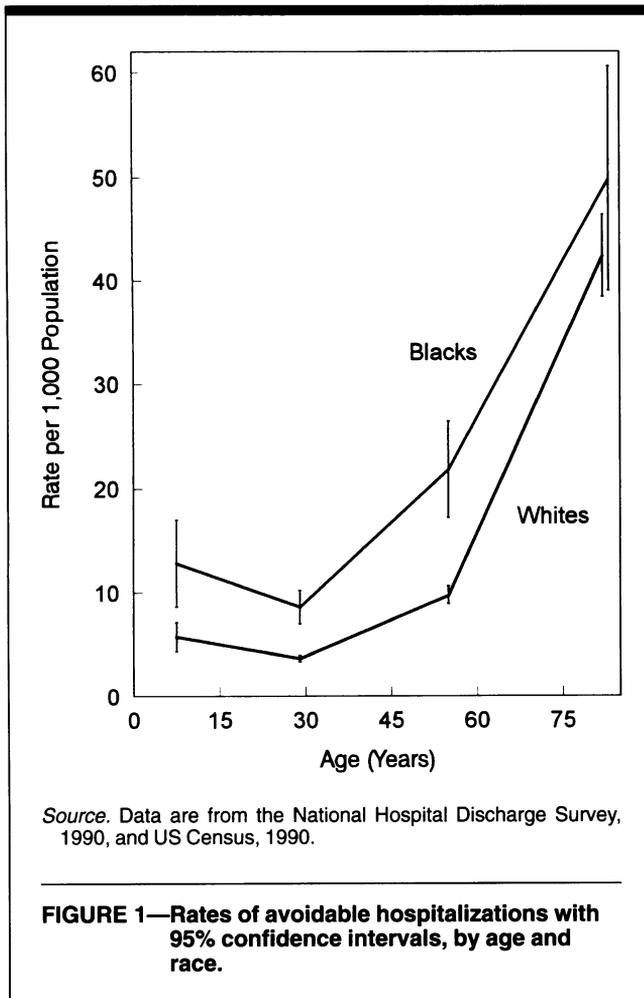
for White patients than for patients of other groups.[17]

With numbers of hospitalizations as numerators, we calculated hospitalization rates after estimating populations at risk for denominators. These estimates were made from data on a public-use summary tape file (no. STF3B) of the 1990 Census. We used census estimates of median household income within zip codes to classify residential areas into one of four income groups: less than $20 000 (13% of US population); $20 000 to less than $30 000 (39% of US population); $30 000 to less than $40 000 (27% of the US population); and $40 000 and greater (21% of the US population). Median household income was chosen to measure social class after several variables were investigated, including percentage of persons in a zip code with at least a college education, employed with a managerial or professional occupation, or living below the poverty line; percentage of households in a zip code with non-wage income or owner occupied; and an index combining all these variables. Each of these stratification variables had a similar relationship

with the rate of hospitalization for avoidable conditions.

For persons under 65 years of age, rates were also computed for three insurance categories—private insurance, Medicaid, and uninsured—determined by the expected principal source of payment reported in hospital discharge records. These three categories accounted for approximately 80% of the hospitalizations for patients under 65 years of age. Patients were classified as uninsured when "self-pay" was the principal expected source of payment. The populations of these groups were estimated from the 1990 National Health Interview Survey (NHIS), which included a question on insurance coverage. The NHIS is a survey of the civilian, noninstitutionalized US population.[18] Sample weights of the NHIS are adjusted to agree with the Census Bureau estimates of 60 age-sex-race specific subgroups. The four median income groups in this study were constructed using the zip codes of residence in the NHIS.

To protect the confidentiality of hospitals and patients, the National Center for Health Statistics does not release

FIGURE 1—Rates of avoidable hospitalizations with 95% confidence intervals, by age and race.

Source. Data are from the National Hospital Discharge Survey, 1990, and US Census, 1990.

FIGURE 2—Rates of avoidable hospitalizations relative to rates in high income ($40 000+) areas, by age and median income of zip code area.

Source. Data are from the National Hospital Discharge Survey, 1990, and the US Census, 1990.

NHDS and NHIS data with identifiers for small areas like zip codes.

Age Adjustments, Rate Ratios

Direct age-adjusted rates were computed using the 1990 population as a standard for each income/insurance/racial group in the population. Relative rates were calculated using the highest income group as a baseline. The rates of the other income groups were expressed as a ratio to the baseline. If the age-specific rate of the baseline and the comparison group were equal, this ratio would be one.

All hospitalizations for avoidable conditions cannot be prevented at current levels of medical technology, particularly for the elderly. Thus, we calculated the number of hospitalizations that would have occurred if all median income groups had the same rate of hospitalizations for avoidable conditions as the $40 000+ group: we multiplied the age-specific rates of hospitalizations for avoidable conditions for the $40 000+ group by the age-specific population estimates for each of the other income groups. The

resulting "expected" numbers of hospitalizations for avoidable conditions were subtracted from the actual numbers obtained from the NHDS for each age and income group under $40 000. We call the sum of these differences the number of "excess" avoidable hospitalizations.
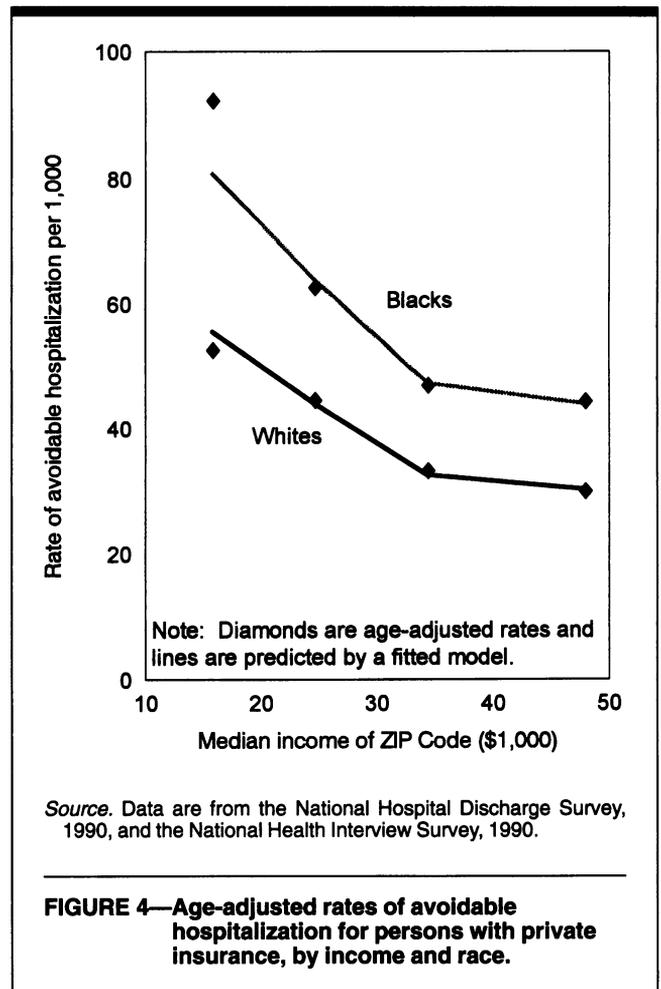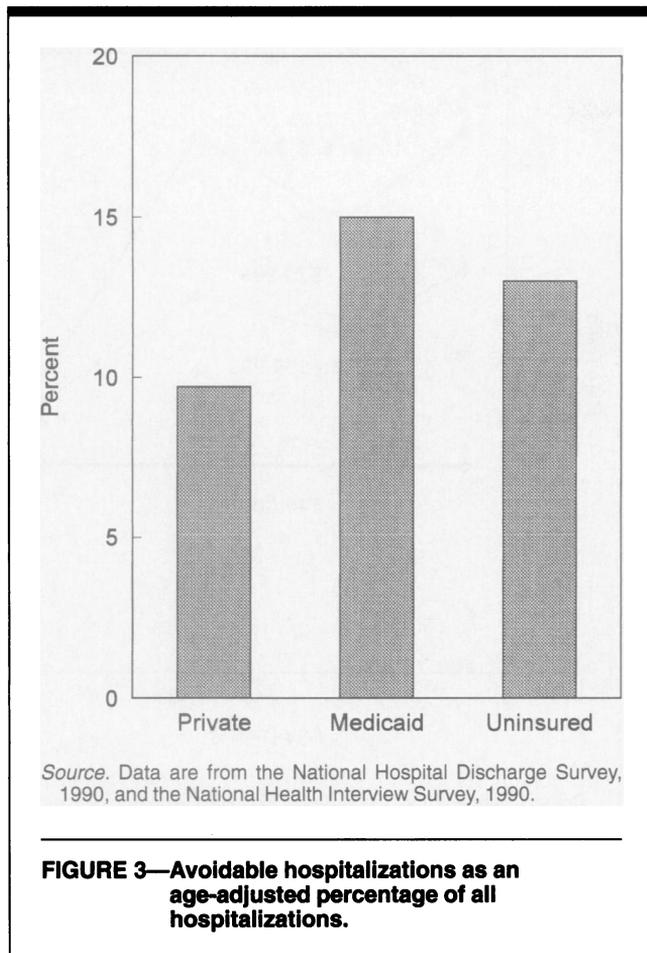
Statistical Testing

We evaluated the statistical significance of our results by calculating 95% confidence intervals for all estimates. Confidence intervals around estimates were computed by adding plus and minus 1.96 times the standard error of the estimate. We only report differences that are statistically significant at less than the .05 level of probability based upon nonoverlapping confidence intervals. We estimated standard errors of estimates for numbers of hospital discharges from the NHDS and population estimates from the NHIS using SUDAAN, a program that takes into account the complex design of these surveys.[19] Denominator data from the census were assumed to be free of sampling error. The conventional formula

was used to calculate standard errors for rates.[20(pp339–356)]

We fit linear models using the program GENCAT.[21] This program uses a weighted least squares procedure to calculate chi-square statistics testing the fit of models to data and the significance of model parameters. With GENCAT we were able to combine the estimated standard errors from SUDAAN for the different surveys and perform significance tests on multivariate models. GENCAT was used to test whether class and race had effects on rates of avoidable hospitalizations among the privately insured.

Results

An estimated 3.1 million hospitalizations were for conditions for which hospitalization was potentially avoidable (Table 1). This was 12% of all hospitalizations in 1990 (adjusted to exclude psychiatric admissions, women with deliveries, and newborns). The proportion of discharges that were potentially avoidable did not vary greatly by region: Northeast, 11%; Midwest, 13%; South, 12%; and

FIGURE 3—Avoidable hospitalizations as an
age-adjusted percentage of all
hospitalizations.

Source. Data are from the National Hospital Discharge Survey,
1990, and the National Health Interview Survey, 1990.

Source. Data are from the National Hospital Discharge Survey,
1990, and the National Health Interview Survey, 1990.

FIGURE 4—Age-adjusted rates of avoidable
hospitalization for persons with private
insurance, by income and race.

West, 12%. The average length of stay for
all avoidable conditions was 7.2 days.

Children under 15 years of age had
439 000 hospitalizations for avoidable
conditions, which was 19% of all dis-
charges (adjusted as above) for this age
group. Avoidable conditions accounted
for 27% of all adjusted discharges for
children 1 to 4 years of age, compared
with 11% for children under 1 year and
19% for those 5 to 14 years of age. Most
of the potentially avoidable hospitaliza-
tions of children under age 15 were for
two conditions: pneumonia (43%) and
asthma (39%).

For patients 15 to 44 years of age,
there were 556 000 potentially avoidable
hospitalizations, which was 8% of their
adjusted total discharges. This age group
experienced a variety of avoidable condi-
tions, with pneumonia (25%), asthma
(21%), cellulitis (17%), pyelonephritis
(12%), and diabetes (9%) the most
common.

The 45- to 64-year age group had
577 000 hospitalizations for avoidable
conditions, which was 10% of their
adjusted total discharges. Pneumonia

(26%) and congestive heart failure (23%)
were their most frequent avoidable condi-
tions, followed by asthma (15%) and
cellulitis (13%).

Almost half of hospitalizations for
avoidable conditions—1 534 000—were
for patients 65 years of age and over. This
was 15% of their adjusted total dis-
charges. Most of the potentially avoidable
hospitalizations for this age group were
for congestive heart failure (40%) and
pneumonia (35%).

Blacks had rates of potentially avoid-
able hospitalization more than twice the
rates of Whites for each of the three age
groups under 65 years of age (Figure 1).
The rates for Blacks and Whites were not
significantly different for persons 65 years
of age and over.

Among persons under 65 years of
age, middle- and low-income area resi-
dents were more likely to experience a
hospitalization for one of these conditions
than were residents of wealthier areas
(Figure 2). The lowest income group (less
than $20 000) had rates 2.1 to 2.6 times
the rates of the highest income group
($40 000+) for each age group under 65

years. These income differences were
similar for Blacks and Whites.

Age-adjusted rates of potentially
avoidable hospitalization per thousand
population were 23 for Medicaid, 3 for
private insurance, and 4 for uninsured
groups. A similar pattern was noted for
overall rates of hospitalization by insur-
ance categories. However, a smaller pro-
portion of patients with private insurance
(10%) experienced a potentially avoidable
hospitalization than was the case for
patients without insurance (13%) or on
Medicaid (15%) (Figure 3).

Among the privately insured, area
income and race remained associated with
rates of potentially avoidable hospitaliza-
tion for persons under 65 (Figure 4).
Middle- and lower-income groups were
more likely than groups from the highest-
income areas and Blacks were more likely
than Whites to experience avoidable
hospitalizations. The fitted GENCAT
model demonstrates that there are signifi-
cant class and racial effects for these
avoidable hospitalizations among the pri-
vately insured.

Among those on Medicaid, Blacks also had higher rates of hospitalization than Whites for avoidable conditions, but there were no statistically significant differences for those living in zip codes with median incomes below $20 000 compared with those with incomes of $20 000 and greater. The number of uninsured patients in this data set was too small to investigate by income and race.

Assuming that the rates of potentially avoidable hospitalization found in the wealthiest areas could be achieved in all areas, there were more than 844 000 excess hospitalizations in 1990. This was 3.7% of all hospitalizations and 29% of the potentially avoidable ones.

Discussion

This study reveals a substantial national problem with hospitalizations that may be prevented with timely, appropriate ambulatory care. Residents of middle- and lower-income areas are more likely than residents of the wealthiest areas and Blacks are more likely than Whites to be hospitalized with conditions for which hospitalization is potentially avoidable. It is especially troubling that substantial gaps in potentially avoidable hospitalization exist for children of different socioeconomic groups. In 1991 there were 14.2 million children (20.6% of all children) in households with incomes below the poverty line; 3.2 million of these children (22.5%) were without health insurance.[22,23]

These striking class and racial differences in rates of potentially avoidable hospitalization were observed with the NHDS for those under 65 years of age but not for the elderly. The narrowing of the gap in avoidable hospitalization in the older age group may be due to increased access to primary care afforded by the Medicare program. A recent analysis of Medicare data, using a different definition of social class and a different potentially avoidable condition list, reports class differences among those over 65.[24] This discrepancy between the two studies may be more apparent than real. Class differences may exist among the elderly but may be smaller in magnitude than those for younger age groups, which are significant in the sample data examined here.

Proposed outcomes measures must be evaluated further to determine which conditions are most useful and to what extent they are truly avoidable. Some conditions included on lists of avoidable hospital conditions may not be avoidable

even with adequate ambulatory care. Infant pneumonia, for instance, typically has a sudden onset and requires immediate hospitalization. Nonetheless, the Weissman et al.[7] list of avoidable hospital conditions used in our study produces a conservative estimate of potentially avoidable hospitalizations. Billings et al.[8] have suggested a more extensive list that includes conditions such as convulsions, dehydration, and gastroenteritis. However, neither list has included hospitalizations that might be avoided with improved ambulatory care for psychiatric conditions,[25] complications of delivery, or care for newborns. Validation studies of these indicators are needed to assess the degree to which hospitalizations for these conditions are indeed avoidable. Using the Billings et al.[8] list with the data analyzed here, we found similar relationships of potentially avoidable hospitalization with area income and race and a similar proportion of hospitalizations that were excess. The estimate of the number of ambulatory-sensitive hospitalizations for 1990 was about 5 million, of which about 1.4 million (28%)—or 7.1% of all hospitalizations—were excess.

Other explanations of the relationships that we have observed must be investigated. Social class is a powerful determinant of health, the need for health care, and patterns of access.[26,27] The underlying social distribution of disease is the same as that of potentially avoidable hospitalizations in this country; it is possible that class differences in rates of potentially avoidable hospitalization are determined by disease prevalence rather than by access to care. However, no class differences in potentially avoidable hospitalizations were observed among children in Spain, a country with universal health insurance and a formal system that ensures access to primary care.[28] Bindman et al.[6] investigated whether differences in disease prevalence, health care–seeking behavior, and physician practice style could explain patterns of hospitalizations sensitive to ambulatory care. They found that even though rates of ambulatory care–sensitive hospitalization did vary with prevalence of selected chronic diseases, these rates also varied with indicators of perceived problems with access to medical care and with the proportion of populations reporting no regular source of care. Physician practice style and health care–seeking beliefs did not have independent effects on preventable hospitalizations in their study.[6]

Caution should be used when comparing insurance status categories, which represent risk-selected groups, with distinct sociodemographic characteristics and health status. Medicaid recipients are more likely to perceive themselves in poor or fair health, report more limitations of activities, and have more chronic or serious disease than patients with private insurance or no insurance.[1]

The uninsured is a heterogeneous group and not the young, healthy middle class, as has been suggested in some studies.[29] While the uninsured have an age distribution similar to that of the general population under 65, they tend to be poorer. Fifty-nine percent of the uninsured have incomes between the federal poverty line and four times that line (between $13 359 and $53 436 for a family of four in 1990[30]). The lowest rates of insurance coverage are found among those with income near but above the poverty line; families with these incomes often are supported by workers whose jobs do not offer insurance.[23] The uninsured report themselves to have better health than those on Medicaid but worse health than those with private insurance.[31] Those without insurance may not be receiving adequate primary care, may postpone seeking needed medical attention, and thus may experience avoidable hospitalizations, or they may seek treatment in emergency rooms where they are treated and sent home without admission.[6]

Even those who have private insurance are not a homogeneous group. Private insurance coverage ranges from basic hospital insurance to comprehensive medical care under a variety of institutional arrangements as diverse as fee for service and health maintenance organizations. Our finding that class differences occur among those with private insurance may be explained by a relationship between the class gradient measured by median income of zip code of residence and financial barriers to adequate primary care, a type of "underinsurance."[32]

The findings of this study suggest that Blacks may experience increased barriers to ambulatory care at each median income group. While methodological studies have shown geocodes to be a robust indicator of individual socioeconomic status,[33,34] median income groups may not be measuring the same things for Blacks and Whites. Within each median income group, Blacks have lower median incomes than Whites. Blacks are more likely than Whites to reside in the more populous zip codes, which are likely to be

more heterogeneous with respect to household income. The heterogeneity within zip codes may decrease the association between median income group and access to primary care or hospital use.[35] Social conditions in the central areas of particular older industrial cities, where many Blacks and minority groups[36,37] reside, suggest alternative explanations—urban decay and racism—which may be affecting the association of race with both median income of zip code of residence and quality of health care.

Other limitations of the data used in this study may also affect the patterns of usage observed.[38] Hospitalizations of White patients were underreported to a greater extent than hospitalizations of other racial groups in the NHDS.[17] However, most of the racial differences in avoidable hospitalization rates are too large to be explained solely by underreporting of White patients. Numerators and denominators used in this study come from separate sources with different data collection procedures, possibly biasing our estimates. One example is that persons who report to the NHIS that they are uninsured may find on being hospitalized that they qualify for Medicaid and have Medicaid recorded as their sources of payment in the NHDS.[39] These caveats do not detract from the potential use of avoidable hospital conditions to evaluate changes over time, however, as similar bias should be expected for later estimates.

Despite limitations, potentially avoidable hospital conditions appear to be useful for monitoring national disparities in access across social groups. Hospitalization rates have declined since 1983,[40] and our study suggests that further reductions may be possible. Greater equity in the use of ambulatory care may eliminate excess hospitalization for potentially avoidable conditions. □

Acknowledgments

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