Income, Race, and Surgery in Maryland

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ABSTRACT

Background. We describe common surgical and medical hospital admission rates for Maryland residents, exploring systematic effects of race and income.

Methods. The data comprise Maryland hospital discharges and population estimates for 1985 to 1987. Patient income is the race-specific median family income of residence zip code. Logistic regression is used to measure incidence by race, income, and residence for surgical and medical reasons for admission.

Results. Population rates for discretionary orthopedic, vascular, and laryngologic surgery tend to increase with community income levels. Coronary and carotid artery surgery rates are two to three times higher among Whites. The more discretionary the procedure, the lower is the relative incidence among Blacks. By contrast, admission rates for most medical reasons decline with increasing income levels and are elevated among Blacks. The affluent receive coronary artery procedures whereas the poor are hospitalized for coronary artery disease.

Conclusions. Blacks and the poor appear to have higher illness burdens requiring hospital care. Discretionary surgeries have a White predominance and increase with income; medical admissions have a Black predominance and decline with income. Race and community income level are important factors in differential hospital utilization rates. (*Am J Public Health.* 1991;81:1435–1441)

Introduction

Significant variations in the incidence of common surgical procedures have been observed in the United States, Canada, and Western Europe over the past 50 years, a general finding being intermediate to high variability in surgical rates between population groups.[1–9] The predominant explanation for geographic differences has emphasized physician practice styles. Populations may differ in disease prevalence, demographic characteristics, access to care, and medical resources. These factors are confounded because measurement in geographic studies involves place of residence or exposure. The result is that a high or low surgical rate for a community cannot be ascribed directly to morbidity, access, or medical supply variables. High-rate areas have been suggested as representing "unnecessary" surgery and low rate areas as "underserviced." Underservice has been proposed to explain the equal distribution of "appropriateness" of care observed for Medicare patients receiving procedures in high- and low-rate communities.[9]

Unresolved questions pertain to the interpretation of variations in surgery rates in terms of health benefit, questions that cannot be answered with incidence data alone. The efficacy of some procedures and indications for appropriate intervention have yet to be established. Studies of the variability of surgical opinion report a lack of concordance for several common surgeries.[10] Few procedures have been studied by randomized clinical trials to assess benefits and delineate indications for which benefits might be derived. Without efficacy studies, it is not possible to determine whether a high-rate area indicates overuse or a low-rate area underservice. We include common medical reasons for hospital admission for comparison and as indicators of need for surgery. Our purpose is to describe use of surgical and medical services by race, income, and geographic area in Maryland.

Methods

Data Sources

We derived surgical and medical admission rates from 1985 to 1987 discharge abstracts, collected by the Hospital Services Cost Review Commission (HSCRC), for Maryland patients admitted to acute care hospitals. The abstract includes age, race, sex, zip code of residence, procedures, diagnoses, and diagnosis-related group (DRG). Records for Maryland residents treated in Washington, DC, and northern Virginia hospitals in 1985 are included. These are important for Washington suburbs, where patient migration into the District of Columbia is common, particularly for specialized care provided in the medical centers of the city. Surgical cases are classified by the most important procedure and medical admissions by DRG. We use "incidence" as the count of occurrences of a surgery or DRG. The admission rate is incidence relative to the population at risk by age, sex, race, income, and zip code of residence, irrespective of the hospital providing care.

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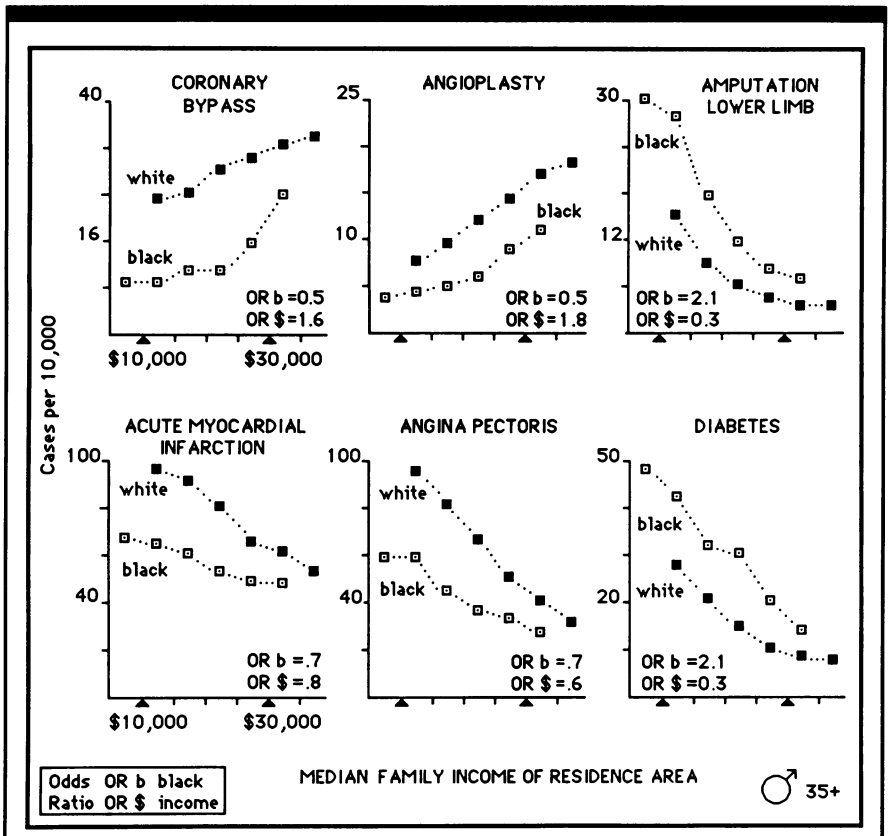

FIGURE 1—Hospital admission rates by race and income, Maryland men aged 35+, 1985–1987.

Population

Maryland's 1986 population of 4.4 million was distributed in 485 zip code areas, grouped into 115 areas by combining adjacent small zip codes. Populations were derived from the 1980 census and 1986 county projections by age, race, and sex.[11] Nonwhite nonblacks constitute under 5% of non-Whites and are classified as Black. Blacks, who make up 27% of Maryland's population, predominate in low-income areas constituting the majority of the poor. Appalachian western counties and high-income suburbs have few Blacks. Four Baltimore City zip codes are 90% White and three are more than 90% Black. We used race-specific median family income of zip code of residence in our analysis because income was not available in the patient record. Zip code median incomes for Whites ranged from $7000 to $58 000, medians for Blacks averaged one third less. We estimated separate medians by race because of wide income gaps between Blacks and Whites living in the same zip code. Variability within areas limits the value of group median income, possibly resulting in attenuation of relationships of surgery and DRG rates with income. There were no ready means for projecting 1979 census incomes to 1986 to account for declines among the poor and increases among the wealthy. Few problems arose in uniformly poor areas and in homogeneous suburbs. Problems did occur in zip codes with wide income variation and pockets of affluence or poverty.

Statistical Methods

The indirect surgical rate for an area is the ratio of observed/expected cases; expectations were based on Maryland age-specific rates. The distribution of 115 area case ratios for a procedure around the state average of 1.0 includes random and systematic components of variance described by MacPherson.[6] The random component depends on the number of cases, whereas the systematic component (SCV) reflects systematic effects above random variation. Incidence is related to multiple factors through coefficient beta in logistic regression.[12] A case is coded "1" and a population datum "0" within age, race, sex, income, and area classes. The estimate b and its standard error SE(b) provide a test of the hypothesis of no effect of the factor. The odds ratio OR = Exp[rb] is relative incidence over the range (r) adjusted by the factors in the model. With r = 1, OR(male) compares males with females (M = 1 and F = 0) and OR(Black) compares Blacks with Whites (B = 1 and W = 0). Age is coded in 10-year groups from under 5 years to 75 years and over. For income coded in $1000 units, we used r = 20 with an interval of 10 to 30 because there were few Whites living in areas with a median below $10 000 and few Blacks living in areas above $30 000. OR(income) = Exp[20b] compares areas with medians of $30 000 with areas with medians of $10 000.

Race and Income Trends

We use first order models for simplicity of presentation. Small deviations of the betas from 0 and minor differences between slopes are often significant when regression is applied to large populations. Figure 1 shows examples of surgical and DRG admission rates with differing income trends by race. Odds ratios are included for comparison with the trends. The rates pertain to men over 35 years of age, with the 115 zip code areas grouped into $5000 income classes. Coronary bypass and angioplasty rates increase over 60% with income for both races. With an OR of 0.5, Blacks have lower rates within each income class, indicating presence of a race effect over and above income. Nonparallel income trends by race are seen, with race differences that are pronounced among low-income groups and reduced among higher income groups. By contrast, admissions for acute myocardial infarction and angina pectoris decline with income and are reduced among Blacks. Thus, coronary artery disease is high among the poor and coronary artery surgery is high among the more affluent. A different set of relationships is present for diabetes and the complication of limb amputation for metabolic or endocrine reasons. The income OR of 0.3 indicates marked declines in diabetes and amputation rates over incomes and the Black OR of 2.1 indicates twofold higher rates among blacks. The race–income interactions are small but statistically significant. Their introduction into logistic models adds complexity without clarification. The income OR is an average for the races and the Black OR is an average over incomes.

Results

Small Area Variation in Surgery Rates

Figure 2 illustrates geographic distributions with frequency histograms of case

ratios for Whites in the 115 Maryland areas. The distributions describe total variation, including random components and SCVs. More than half of the areas have few Blacks, particularly suburban, rural, and western areas. Heterogeneity is reduced by limiting the figures to Whites. We include common surgeries and surgeries with low and high geographic variance. Coronary bypass, cholecystectomy, and hysterectomy are the leading Maryland surgeries based on total hospital charges per capita.

Procedures among Women

Mastectomy (simple and radical) had the lowest variance of the surgeries studied (SCV = .03). The low variance reflects uniform incidence and detection of breast cancer and medical consensus as to its management. Reduction mammoplasty had the highest variance observed (SCV = 1.07), its use increasing markedly with income. Generally, cosmetic procedures have high systematic variances based on patient demand and income. Cesarean section had low geographic dispersion, indicating similar obstetrical approaches throughout the state. Hysterectomy had moderate variance (SCV = .08). Cholecystectomy varied twofold between moderate-income South Baltimore and affluent North Baltimore. Variation may be explained by different social factors, approaches to management, or incidence of cholelithiasis in these populations.

Procedures among Men

Prostatectomy and inguinal hernia repair were nearly uniform across the state. The low SCVs suggest uniform prevalence and apparency of indications, agreement as to management, and few barriers to care. Nondiscretionary appendectomy had an outlier in Cambridge, with eight times the rate of nearby Annapolis. The high surgery rate may be due to high incidence of appendicitis, to a lower threshold for surgery, or to a high rate of false positive indications. Laminectomy was discretionary, with incidence varying fourfold between southwestern Baltimore and the Eastern Shore. The latter region may be underserved by orthopedic surgeons. Differentiating overuse in one area from underuse in another implies study of appropriateness and geographic and occupational variations in spinal disk problems. Coronary bypass had high geographic variability (SCV = .63). Explanation requires distinguishing among disease effects, access, referral, and criteria for case selection.

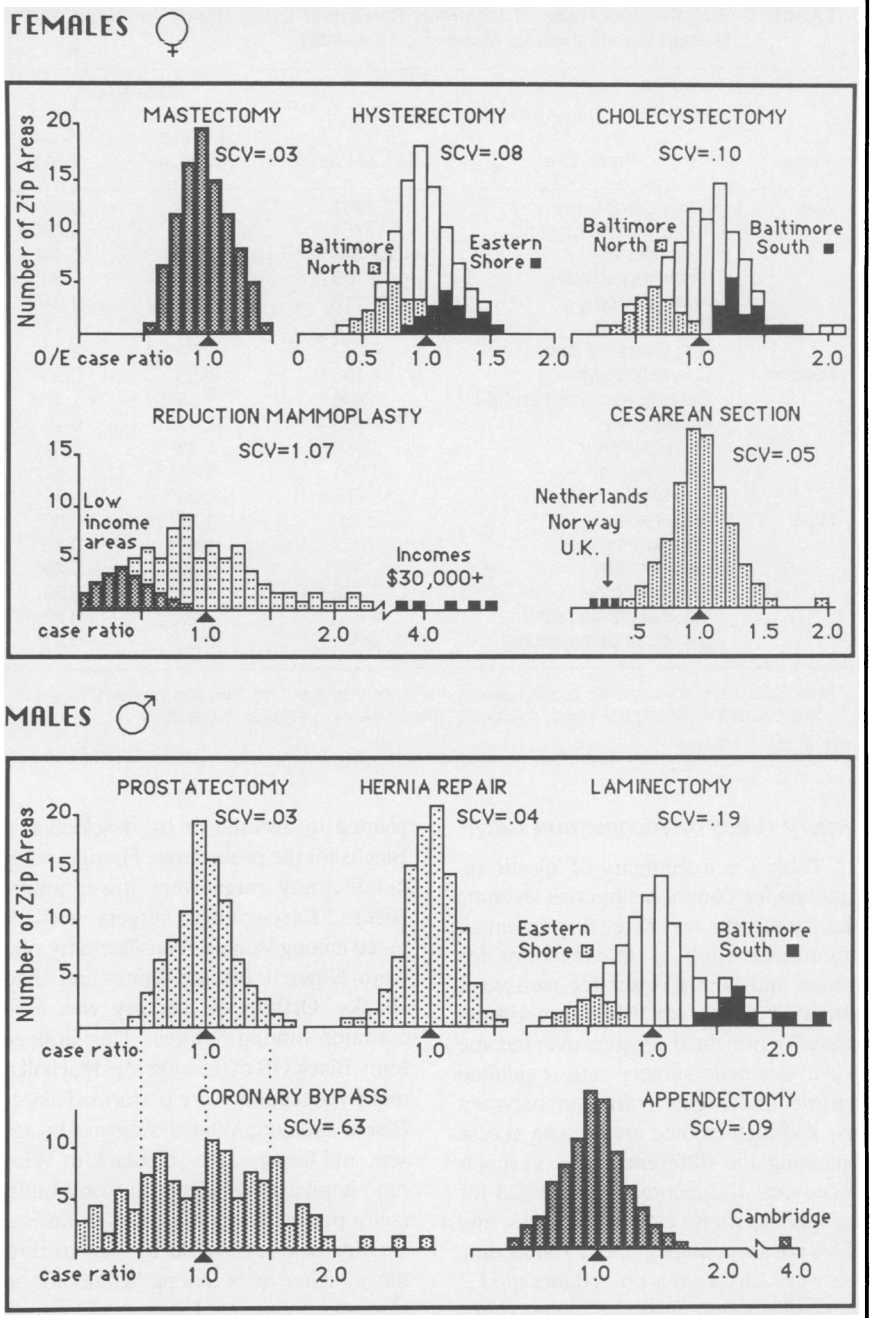

FIGURE 2—Relative incidence of procedures among Whites in 115 Maryland ZIP code areas, 1985–1987.

Variability of case ratios among the 115 small areas was observed for each procedure by statistical test, including low-variation mastectomy and inguinal hernia repair.[6,13] For common surgeries, small deviations from randomness are significant because of sample size alone. Tests for uniformity of rates provide little new information because the null hypothesis is almost always rejected. Local variations in surgical practice were present for many procedures. The distributions reflect reported services as delivered in Maryland during the study period. The low variance of cesarean section rates (SCV = .05) points out a limitation of small area analysis. The state average is a yardstick for comparing the 115 areas, not an objective standard. The Maryland cesarean rate is two to three times that of Western European countries.[14] We found no definitive results relating obstetrical practice differences to birth outcomes on a population basis. A similar situation held for many discretionary surgeries.

TABLE 1—Relative Incidence of Common Surgeries: Odds Ratios for Race and Median Family Income, Maryland, 1985–1987

Sex	Procedure	No. of Cases	Odds Ratio: Income (high/low)	Odds Ratio: Black (B/W)
Both	Sinus procedures	7781	1.23*	0.80*
	Total hip replacement	7761	1.22*	0.73*
	Tonsillectomy	22 743	1.13*	0.44*
	Hemorrhoidectomy	12 105	1.05	0.69*
	Appendectomy	13 112	1.01	0.64*
	Gastrectomy	2972	0.68*	1.47*
	Amputation of limb	7077	0.29*	2.03*
Female	Cosmetic surgeries	8135	4.53*	0.30*
	Operations on foot and toe	3655	1.58*	1.97*
	Mastectomy	6665	1.49*	0.96
	Thyroidectomy	2857	1.48*	1.51*
	Hysterectomy	28 891	1.21*	1.42*
	Cholecystectomy	15 776	0.54*	0.56*
Male	Angioplasty	3439	1.82*	0.52*
	Coronary bypass	7209	1.62*	0.45*
	Laminectomy	7441	1.42*	0.49*
	Prostatectomy	17 762	1.12*	0.99
	Inguinal hernia repair	14 628	1.02	0.78*
	Carotid endarterectomy	2244	0.83*	0.31*

Note. Odds ratios are based on logistic regression of surgery by age, race, sex, and income. Cosmetic procedures include blepharoplasty, rhinoplasty, mammoplasty, and facial rhytidectomy.
*$P < .01$

Surgery Rates by Income and Race

Table 1 is a summary of logistic regressions for common surgeries showing ORs for income and race. Sex-dominant procedures such as mastectomy for women and hernia repair for men were computed for one sex. Most surgeries increased or remained constant over income levels. Cosmetic surgery rates exhibited fourfold and higher variation between low- and high-income areas, with access explaining the difference. For vascular procedures, the income OR was 1.8 for angioplasty, 1.6 for coronary bypass, and 1.5 for coronary angiography. The income ORs were 1.6 for sinus procedures and 1.3 for tonsillectomy. Orthopedic procedures involving hip, knee, and spine increased with income. Inguinal hernia repair, appendectomy, and prostatectomy were not related to income. The income OR was 0.5 for cholecystectomy, one of the few discretionary surgeries that declined with income. Women in high-income areas had half the gallbladder surgery rate of women in low-income areas. The lowest surgical income OR was 0.3 for nondiscretionary amputation of limb for endocrine and metabolic reasons. Many of these cases were diabetics with peripheral vascular disease.

Whites had higher rates than Blacks for most discretionary surgeries. The low Black OR for elective surgeries is explained by income or by deselection of Blacks for the procedures. Hernia and appendectomy rates were lower among Blacks. Laryngologic surgery was elevated among Whites. Tonsillectomy rates were 29 per 10 000 for Whites and 13 for Blacks. Orthopedic surgery was more common among Whites. The laminectomy Black OR of 0.5 indicates that half as many procedures were performed among Blacks as among Whites. Adjusted by age, sex, and income, the 1:2 Black to White ratio implies that race was a contributing factor per se. Race differences in vascular surgery were measured by two to three times higher rates among Whites for angioplasty, coronary bypass, and carotid endarterectomy. Prostatectomy and mastectomy exhibited no race difference. Gynecologic surgery was higher among Black women, with a Black OR of 1.2 for hysterectomy. Foot operations, including excision of bunion and arthroplasty, were twice as common among Blacks. Either Blacks had more foot problems requiring care or they received more inpatient surgery because of differing medical practice. Nondiscretionary gastrectomy and limb amputation were elevated among Blacks (ORs = 1.5 and 2.0). Discretionary aspects of common vascular, orthopedic, and laryngologic procedures suggest that lower rates for Blacks were related to referral and access rather than morbidity.

Medical Admissions

Table 2 shows ORs for common medical DRGs. Persons living in low-income areas were more likely to be hospitalized for medical reasons than persons in high-income areas. This pattern suggests an income relationship whereby the poor have a higher incidence of conditions requiring hospital care. For all medical DRGs, the income OR of 0.6 was a decline of 40% over incomes from $10 000 to $30 000 per year. Angina pectoris, hypertension, and heart failure rates decreased by more than half with income. The income OR was 0.3 for pneumonia and 0.2 for bronchitis and asthma. Rates for alcohol-related DRGs declined by 75% with income, in part reflecting use by those privately insured of treatment facilities not in the HSCRC database. Gastrointestinal obstruction, hip fracture, and medical back problems were among the few common medical DRGs that did not decline in incidence with income.

Women predominated for hip fracture, bowel inflammation, urinary tract infection, hypertension, and diabetes. The high female rates for hip fracture occurred among Whites but not Blacks. Men predominated among heart disease (male OR = 2.0 for acute myocardial infarction). Male-to-female ORs above 3.0 were noted for cirrhosis of the liver and alcohol-related DRGs. Although Blacks had lower surgery rates than Whites, the total medical admission rate was 22% higher for Blacks. Blacks had high ORs of 2.0 for diabetes, 3.0 for hypertension, 2.3 for alcohol-related DRGs, and 5.4 for red blood cell disorders, a difference due to sickle cell anemia. An exception was hip fracture (Black OR = 0.4 for women and 0.8 for men). Among cardiovascular conditions, Whites had higher rates for acute myocardial infarction, angina pectoris, and arrhythmias and Blacks had higher rates for heart failure.

Discussion

Explanations for geographic variations in surgical and medical admission rates have emphasized the role of physician practice style differences reflecting medical uncertainty regarding optimal treatment regimens. Our results indicate that race and income may confound differences between small areas, particularly in states with heterogeneous populations. These demographic factors may influence medical need in terms of disease prevalence and severity as well as the demand

for and access to primary and secondary care. The surgery rate for a community is based on multiple factors, including demography, morbidity, access to care, referral practice, physician decisions concerning patient management, and medical resources.

Generally, small area data are unavailable for incidence or prevalence of conditions leading to hospital care. An exception is cancer measured by mortality statistics and tumor registries. Objective definition of disease by pathology, high levels of ascertainment, and concordance among physicians concerning management lead to correspondence between surgical rates and breast cancer incidence. Race differences in mastectomy rates may be related to incidence of breast cancer by income operating through differences in fertility. A review of the role of pregnancy history reports protective effects of early pregnancy and high risk among nulliperous women.[15] Deferred child bearing and lower fertility among the more affluent may explain the income OR of 1.5 for mastectomy, one of the few nondiscretionary surgeries increasing with income. Morbidity explains the distribution of mastectomy. By contrast, there is little information on the occurrence of cholelithiasis, prostate hypertrophy, uterine fibroids, and other indications for common surgeries. Morbidity cannot be ruled out as a determinant of surgical rate differences between communities. Uncertainty holds for the relative contributions of disease factors, selection of cases for particular types of care, access, referral networks, and physician practice styles.

Access to care involves patient perceptions, financial means to secure care, availability of care, and the referral network to surgeons, which, if constrained, may result in low surgery rates. Such constraint may hold for Maryland Blacks for elective, vascular, orthopedic, and laryngologic surgery. Most surgeries exhibit either a positive relationship or no relationship to income. An implication is that access factors related to income are determinants of use of discretionary procedures. Among common discretionary surgeries, cholecystectomy has the largest decline with income. The decline for Whites is consistent with a disease hypothesis whereby residents of high-income areas have reduced incidence of cholelithiasis. Management of gallbladder disease and referral behavior in low-rate areas may restrict surgical intervention. Residents of affluent communities are not constrained in access because of limitations in income and insurance coverage. Cholelithiasis increases with obesity and is reduced among higher social classes.[16] Among women, Whites have 50% higher cholecystectomy rates than Blacks despite lower incomes and higher obesity levels among Blacks.[17] Race differences in cholecystectomy may be due to reduced occurrence of gallstones among Blacks or to deselection of Blacks for surgery. Blacks have lower rates for elective, vascular, orthopedic, and laryngologic procedures, whereas parity is seen for prostatectomy and a 22% excess for hysterectomy. The more discretionary the procedure, the lower the relative incidence among Blacks. Discretionary aspects of vascular, orthopedic, and laryngologic procedures and lack of evidence supporting morbidity differences by race suggest that the low rates for Blacks relate to referral and access. There are no definitive studies documenting race differences in prevalence of lesions of coronary and carotid arteries. Mortality data indicate that Blacks have similar or higher death rates than Whites for ischemic heart and cerebrovascular disease. Access, referral practices, and case selection may explain the two to three times higher incidence of vascular surgery among Whites.

Rates for most medical DRGs decline with income, a finding consistent with higher morbidity among low-income groups. Diabetes, bronchitis, and asthma and pneumonia rates decline by two thirds with income. Since diabetes and asthma are thought not to depend on social class, medical management may underlie the declining hospital rates with increasing income levels. In contrast to lower Black rates for most surgical specialties, Blacks have higher rates than Whites for many common DRGs. The relationship between illness measured by hospital admission and surgical use is variable. There is a twofold higher incidence among Blacks for diabetes and the complication of limb amputation for endocrine and metabolic reasons. Coronary bypass, angioplasty, and angiocardiography have similar patterns of use, increasing with income and significantly elevated among Whites within each income group. Race effects are present over and above income. Coronary artery surgery (CAS) increases with income, whereas coronary artery disease (CAD) declines. High CAD rates occur in

TABLE 2—Relative Incidence of Diagnosis-Related Groups (DRGs): Odds Ratios for Race, Sex, and Median Family Income, Maryland, 1985–1987

Diagnosis-Related Group/Medical DRG	No. of Cases	Odds Ratio		
		Income (high/low)	Male (M/F)	Black (B/W)
Nervous system	80 421	0.6*	1.1*	1.0
Transient ischemic attack	10 842	0.8*	1.1*	0.9*
Seizure and headache	16 082	0.4*	1.0	1.0
Circulatory system	178 270	0.7*	1.4*	0.9*
Acute myocardial infarction	32 297	0.8*	2.0*	0.7*
Arrhythmia	20 306	0.6*	1.3*	0.9*
Angina pectoris	35 737	0.5*	1.1*	0.8*
Hypertension	5908	0.5*	0.7*	2.8*
Heart failure and shock	33 820	0.4*	1.2*	1.2*
Gastrointestinal system	110 086	0.7*	1.0	1.0
Obstruction	6721	1.1*	0.8*	1.1
Hemorrhage	13 078	0.8*	1.5*	1.3*
Cirrhosis of liver	2756	0.2*	3.1*	1.2*
Respiratory system	122 385	0.4*	1.2*	1.0
Pulmonary edema	17 928	0.4*	1.6*	1.0
Pneumonia and pleurisy	32 334	0.3*	1.2*	1.0
Otitis media and URI	8053	0.3*	1.0	0.5*
Bronchitis and asthma	38 451	0.2*	0.9*	1.0
Other medical DRGs				
Hip fracture	2791	1.2*	0.6*	0.6*
Medical back problems	40 659	1.0	1.1*	0.8*
Red blood cell disorders	9422	0.8*	1.0	5.4*
Urinary tract infections	17 597	0.5*	0.4*	1.0
Diabetes	17 343	0.3*	0.8*	2.1*
Alcohol-related DRGs	19 446	0.3*	3.6*	2.3*
All medical admissions	1 478 027	.6*	1.2*	1.2*

*$P < .01$

low-income areas and high CAS rates in high-income areas, a discordancy between treatment and need as measured by these means. Blacks have 20% lower rates for CAD and markedly lower rates for CAS (Black OR = 0.4 for coronary bypass and 0.5 for angioplasty). The race difference for CAS is highest among low-income groups and approaches parity among the more affluent. Maryland Blacks have access to hospital care for medical reasons and are deselected for discretionary procedures in at least three surgical specialties. Morbidity explanations for most of the medical and surgical admission rate differences by race and income remain to be elaborated. A general conclusion is that the medical care system of Maryland constrains the use of discretionary vascular, orthopedic, and laryngologic surgery by the poor and by Blacks.

Incidence rates based on hospital abstracts and population projections have several limitations. Data problems are inherent in an administrative health data system with 55 participating hospitals. A major constraint is inability to link records for multiple admissions of a patient. Patients seeking care in other states are not reported. A check of border areas does not indicate abnormal rates. No information is available on quality of abstracting. Formal errors are present with impossible combinations of ICD codes by sex and age (e.g., men with gynecologic diagnoses and the aged with perinatal conditions). Errors of this type are rare compared with factual errors undetected by editing. Experience in other settings may be relevant. After the swine flu affair, record reviews of abstracts with Guillain-Barre syndrome and abstracts with tuberculosis as comorbidity revealed nearly 100% false positives due to miscoding.[18] A reliability study comparing records with independent reabstracts found three-digit ICD agreement ranging from 34% for chronic ischemic heart disease to more than 90% for surgical diagnoses.[19] It is likely that error rates are now reduced through more careful scrutiny and use of records in reimbursement. There are uncertainties regarding populations and assignment of residence. There are abstracts with zip codes not in the postal directory and no zip codes for the homeless. Baltimore's Central Post Office is zip 21203 coded for patients by HSCRC but with no census count and over 5000 PO boxes, the size of a town. Questions pertain to 1986 county projections applied to small areas because population growth and loss rates are not uniform for zip code areas within Baltimore City or suburban counties. Use of zip code median income for individual patient income is a major, unavoidable limitation. As unassembled intelligence, the data require caution in drawing conclusions. For these reasons, we emphasize large differences not likely to be explained by artifacts of measurement.

We used population rates because of epidemiological interest and concern regarding selection bias with inpatient data. Population rates are resultants of morbidity, access, and selection factors, whereas hospital rates relate to preselected inpatients. Case fatality depends on treatment and prognosis, with clinical details on severity not routinely available. Two recent inpatient studies illustrate ambiguity due to possible selection bias. A case fatality study for uninsured patients assigns prognosis using diagnosis, age, race, sex, and comorbidity.[20] Higher death rates are reported for the uninsured. The authors note that the mortality difference "also could be due to differences in severity of illness between the uninsured and privately insured," a reference to selection bias. It is plausible that the uninsured defer seeking care and have less favorable prognoses at time of hospitalization. A CAS study explores "whether there are different procedure rates for black patients once they are hospitalized for serious cardiovascular conditions."[21] The series consists of patients with coronary artery procedures or with principal diagnosis of circulatory disease, including ischemic heart disease (IHD) and non-IHD circulatory diseases. Non-IHD patients with hypertension or cerebral hemorrhage ordinarily do not receive CAS. The authors show CAS rates of 0.4% for non-IHD and 39% for chronic ischemia patients, a hundredfold difference. There is an excess of Blacks in the low-risk groups. In Maryland, most CAS cases have coronary ischemia with selection and surgery scheduled before, not after, admission. Thus, Pr{CAS|coronary ischemia & CAS scheduled} is about 1 and Pr{CAS|hypertension or stroke} is about 0. We concur with the finding of race differences in use of CAS but based on population studies. Population-based rates avoid some of the uncertainties involved in measuring risks among preselected patients. Central issues in population studies are factors leading to selection for hospitalization.

We have described variations in surgical and hospital care by race and income for Maryland during 1985 through 1987. Our results show that the more discretionary the procedure, the lower its relative incidence among Blacks and the poor. Admissions for common medical reasons are elevated among Blacks and decline with increasing income for both races. Varying rates between communities reflect the interplay of diverse factors, including patient behaviors, morbidity, access, physician practice styles, referral, and resource availability. Each factor has different implications for strategies designed to reduce health care costs, to improve quality of care, and to help ensure equitable allocation of care. Incidence data using hospital records and population estimates alone cannot clearly distinguish between these effects and can only provide indicators of unexplained variability and measures of low and high occurrence rates. Incidence data can be used to target potential problems, to assist in assigning priorities for special investigation, and to provide descriptions of medical care impacts on population groups. □

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