

Preventable Hospitalizations And Socioeconomic Status

Failure to consider patients' characteristics may lead to the false conclusion that care is of poor quality.

by Jan Blustein, Karla Hanson, and Steven Shea

ABSTRACT: "Preventable" hospitalizations have been proposed as indicators of poor health plan performance. In this study of elderly Medicare beneficiaries, however, we found that preventable hospitalizations are also more common among elders of lower socioeconomic status (SES). The relationship persisted even when an up-to-date severity-of-illness adjustment system was used. To the extent that indicators of health plan "performance" reflect enrollees' characteristics, plans will be rewarded for marketing their services to wealthier, healthier, and better-educated patients. Further work is needed to clarify issues of accountability for preventable hospitalizations and other putative indices of health plan performance.

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PAYERS, POLICYMAKERS, AND PATIENTS share an interest in developing "report cards," which allow performance to be compared across health plans. Of the various indices of plan quality that have been proposed, one of the most interesting is that of preventable hospitalizations. These events have been proposed as indices of the quality of health care because, in theory, "timely and effective outpatient care can help reduce the risks of hospitalization either by (a) preventing the onset of an illness or condition; (b) controlling an acute episodic illness or condition; or (c) managing a chronic disease or condition."¹ Examples include hospital admissions for asthma, diabetic ketoacidosis, and congestive heart failure.²

Studies have confirmed that poor access to primary care is an important risk factor for these events. However, it has become increasingly clear that other factors matter. For example, a recent study of California communities showed that income, level of educational attainment, and disease prevalence are important predictors

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of preventable hospitalization rates, even when variations in access to care are taken into account.³ Another study found that Canadians residing in low-income communities were 40 percent more likely to experience “preventable” hospitalizations than were their counterparts residing in high-income communities, in a nation where all citizens enjoy good financial access to care.⁴ From the perspective of monitoring health plan performance, these findings present an important challenge. If preventable hospitalization rates are to be used for cross-plan comparisons, then these other factors, which may differ across populations enrolled in health plans, may need to be considered. For if they are not, plans might achieve favorable performance ratings simply by enrolling wealthier, better-educated persons, or those with a lesser burden of chronic disease.

It is important to distinguish between differences in hospitalization rates that arise from variations in underlying health status, differences that are attributable to variations in provider practices, and those that are attributable to other patient factors. Adjusting for severity of illness may be helpful in sorting these out. Certainly, poorer, less educated, minority populations are prone to ill health and therefore may be more prone to needing hospitalization.

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In this study we examine the extent to which basic demographic factors—race, income, and educational attainment—are associated with preventable hospitalizations, after using currently available “severity adjustment” strategies.⁵ Relationships between hospitalization rates and factors that persist after severity adjustment may reflect providers’ practices, patients’ behavior, or incomplete adjustment. We consider each of these three possibilities.

To investigate the impact of severity adjustment, we examine preventable hospitalizations in a cohort of Americans—Medicare beneficiaries—who enjoy relatively good access to primary care. These persons generally have a usual source of care, see their physicians more than once a year, and report high levels of satisfaction with their care.⁶ By examining occurrences of preventable hospitalization in individual patients (rather than computing rates of preventable hospitalization in communities, as has been done in almost all prior studies), we can use severity adjustment methods similar to those that might be used in health plan report cards.

Methods

Data source and subjects. All information was derived from the Medicare Current Beneficiary Survey (MCBS) public use tapes for 1991 and 1992. Those electronic data sources include survey responses and corresponding billing data from a nationally representative sample of Medicare beneficiaries, followed longitudinally

over two years. The response rate over that period was 77.3 percent. A description of the strategy adopted to weight observations to reflect population characteristics has been published previously, as has a discussion of the multistage stratified sampling design.⁷

The MCBS was conducted as a series of face-to-face interviews, covering a range of topics including subjects' demographics, usual source of primary care, supplemental insurance, self-rated health status, prior medical history, and yearly income for 1991. Relatives or other caregivers were enlisted as proxy respondents for the 11.1 percent of subjects who were unable to participate for themselves.

We examined 1992 hospitalization patterns among Medicare beneficiaries age sixty-five years or older and dwelling in the community at the time of the initial interview (the final four months of 1991). The study design required that medical service use be ascertained by reviewing Medicare bills. Since such bills are not necessarily generated when services are rendered by Medicare health maintenance organizations (HMOs), the 7.3 percent of respondents in HMOs were removed from the analysis, leaving a sample of 7,303 community-dwelling older Americans.

Preventable hospitalizations for "ambulatory care-sensitive" conditions. Hospitalizations during 1992 were identified as "preventable" by the principal diagnosis listed on inpatient bills, using a set of "ambulatory care-sensitive" (ACS) conditions and corresponding *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* codes.⁸ It is worth noting that the ACS conditions were developed to monitor hospitalizations primarily in the population under age sixty-five. At the time of their development, the panel expressed reservations about using the list to classify hospitalizations in the elderly, since some diseases present differently in older populations.⁹ For example, pneumonia—which was included in the original list of ACS conditions—is a common terminal event in older people. Therefore, in the analyses reported here, hospitalizations for pneumonia are not classified as "preventable." However, the reported results were not sensitive to this exclusion.

A total of 316 subjects were admitted to a hospital for an ACS condition in 1992. Most of those admissions were for exacerbations of chronic diseases (heart failure, coronary artery disease, chronic obstructive pulmonary disease, diabetes, and asthma), although some admissions were for more acute problems (kidney/urinary tract infection or dehydration/volume depletion) (Exhibit 1). The total number of admissions for ACS conditions (398) exceeded the total number of persons hospitalized for those sorts of conditions (316), because some persons were hospitalized more than once. However, the unit of analysis for the work reported here was the respondent

EXHIBIT 1**Principal Diagnoses In Preventable Hospitalizations For Ambulatory Care-Sensitive (ACS) Conditions, 1992**

Principal diagnosis	Percent of ACS hospitalizations
Congestive heart failure	32.2%
Angina pectoris	16.3
Chronic obstructive pulmonary disease	11.6
Kidney/urinary tract infection	10.6
Dehydration/volume depletion	7.3
Diabetes "B"	5.0
Asthma	5.0
Gastroenteritis	2.8
Cellulitis	2.5
Grand mal and other convulsions	2.3
Hypoglycemia (unspecified)	1.3
Skin graft with cellulitis	1.3
Severe ear, nose, and throat infections	0.8
Hypertension	0.5
Diabetes "A"	0.5
Dental	0.3
Tuberculosis (any)	0.0 ^a
Diabetes "C"	0.0 ^a
Pelvic inflammatory disease	0.0 ^a
Malnutrition	0.0 ^a
Immunizable conditions	0.0 ^a

SOURCE: Medicare Current Beneficiary Survey (MCBS) public use file, 1992.

NOTE: Based on 398 preventable hospitalizations, experienced by 316 elderly patients. Some persons were hospitalized more than once. Hospitalizations for pneumonia were not classified as "preventable." See text for details.

^a There were no hospitalizations for these conditions.

(N = 7,303); the dependent variable was having at least one preventable hospitalization.

Adjustment strategies. We investigated three case-mix adjustment strategies that might be used to compare preventable hospitalization rates in health plans. The first strategy was simple age and sex adjustment. Because information on enrollees' age and sex is readily available to plans, this strategy could be used to support cross-plan comparisons. The second strategy was to use administrative data (the ICD-9-CM codes appended to billing data). Specifically, we used the ambulatory diagnostic groups (ADGs), a component of the ambulatory care groups (ACG) system, which is reportedly under consideration for adoption by the Health Care Financing Administration (HCFA).¹⁰ The third strategy was to use survey-derived information about general health status and prior medical history. As part of this strategy, prior and present medical conditions were aggregated to form a chronic disease risk score.¹¹ Surveys of health plan populations are expensive and logistically difficult, so adoption of this strategy may be less likely.

Control variables reflecting access to care and prior service use. To examine the adjusted relationship between key demographic factors and the likelihood of preventable hospitalization, it was important to control for access to care and the subject's propensity to receive medical care. While Medicare beneficiaries generally enjoy good access to care, supplemental insurance status and usual source of care can influence the intensity of services received.¹² We therefore included supplemental insurance status and usual site of care in all multivariate analyses. We also included the number of physician visits in 1991 as a control variable, to reflect propensity to seek and receive medical care. Consistent with prior reports, the overwhelming majority of subjects (86.6 percent) had at least one visit to a physician during the year; the median number of annual office visits in the sample was five.

Analytic strategy. Descriptive statistics were developed to characterize the population of Medicare beneficiaries over age sixty-five with respect to demographic characteristics, self-rated health status and medical history, and various indicators of access and prior service use. We then examined the bivariate associations between each of those characteristics and the proportion of older Americans undergoing at least one preventable hospitalization in 1992. Finally, we focused on the three demographic factors—race, education, and income—and their relationship to the likelihood of preventable hospitalization. Multivariate models were developed to examine each of the factors separately using various adjustment strategies.¹³

Findings

Consistent with prior reports, nearly all Medicare beneficiaries have a usual source of care, and most have some supplemental coverage (Exhibit 2). Nearly three-quarters have at least one chronic condition that might predispose them to a preventable hospitalization, and fewer than half rate their health as excellent or very good.

As anticipated, low socioeconomic status (SES) was associated with poor health. For example, among those in the lowest income tercile, 37 percent reported being in fair or poor health, compared with 16 percent of those in the upper income tercile ($p < .001$). Among those in the lowest income tercile, 22 percent reported having three or more chronic conditions that would predispose them to an ACS hospitalization, compared with 17 percent in the highest income tercile ($p < .001$). Differences in underlying clinical status by SES were less pronounced in the administrative data. For example, 39 percent of elders in the low income tercile fell into ADG II (at least one "unstable chronic medical condition"), but 36 percent of high-income elders did also ($p = .04$).

EXHIBIT 2**Characteristics Of Older Medicare Beneficiaries And Corresponding Percentage Of Beneficiaries With A Preventable Hospitalization, 1992**

Characteristic	Percent of older Medicare beneficiaries	Percent having this characteristic with a preventable hospitalization in 1992
Age		
65-69	28.5%	2.2% ^a
70-74	28.8	3.4
75-79	21.0	4.5
80-84	13.0	6.4
85 and older	8.7	6.6
Sex		
Male	40.2	3.6
Female	59.8	4.2
Race		
Black	8.2	4.7
White	88.9	3.8
Other	2.9	5.3
Education level		
Grade school	27.7	5.3 ^a
High school	46.6	3.5
College	25.6	3.0
Income (terciles)		
Low (less than \$9,517)	30.0	5.1 ^a
Middle (\$9,517-\$18,799)	33.7	3.5
High (more than \$18,799)	36.3	2.7
Self-rated health status		
Excellent	18.1	2.1 ^a
Very good	25.5	2.1
Good	30.2	3.3
Fair	19.0	6.5
Poor	7.2	11.2
Chronic disease risk score		
0	28.4	0.9 ^a
1	32.9	3.2
2	19.6	4.8
3 or more	19.1	8.8
Usual source of care		
None	9.3	1.0 ^a
Hospital outpatient/emergency department	3.4	4.2
Physician's office or other	87.3	4.2
Supplemental insurance		
Medicare only	12.5	4.3
Medicare and Medicaid	8.6	5.9
Medicare and employer-sponsored	32.7	3.4
Medicare and self-purchased	46.2	3.9
Annual number of physician visits		
0	14.1	0.6 ^a
1-4	35.6	2.5
5-8	24.7	3.7
9 or more	25.6	7.9

SOURCE: Medicare Current Beneficiary Survey (MCBS) public use files, 1991 and 1992.

NOTES: Based on the sample of 7,303 Medicare beneficiaries. Sample percentages have been appropriately weighted to take into account both MCBS oversampling and nonresponse propensities, in order to reflect U.S. population parameters.

^a $p < .05$ for chi-square test of association between this characteristic and likelihood of preventable hospitalization in 1992.

In 1992, 4 percent of older Medicare beneficiaries nationwide had a preventable hospitalization. Several characteristics measured at the end of 1991 were associated with the probability of such an event (Exhibit 2). The proportion with preventable hospitalizations was greater among beneficiaries of lesser educational attainment, lower income, advanced age, a history of more chronic diseases, and poorer self-rated health status. In addition, having a usual source of care and having a history of frequent physician visits in 1991 were associated with a greater likelihood of preventable hospitalization in 1992.

Exhibit 3 presents the relationships between race, education, and income and the likelihood of preventable hospitalization under various adjustment strategies. Without adjustment, there was a strong relationship between preventable hospitalizations and both low educational attainment and income (column 1). These relationships were attenuated only slightly by adjusting for the available access and prior service use variables (column 2). Age and sex adjustment attenuated these relationships further, and the relationship between education and the likelihood of preventable hospitalization was no longer statistically significant, although the relationship between income tercile and likelihood of hospitalization remained (column

EXHIBIT 3
Odds Ratios For The Likelihood Of Having A Preventable Hospitalization In Groups Of Medicare Beneficiaries Defined By Race, Education, And Income Under Various Adjustment Strategies

	Adjustment strategy				
	No adjustment	Access/prior use only	Access/prior use, and age and sex	Access/prior use, age and sex, and ADGs	Access/prior use, age and sex, and survey-derived data
Race					
Black	1.23	1.10	1.13	1.08	1.03
Other	1.40	1.18	1.24	1.08	1.22
White	1.00	1.00	1.00	1.00	1.00
Education level					
Grade school	1.69*	1.48*	1.37	1.21	1.12
High school	1.09	1.05	1.07	0.98	0.95
College	1.00	1.00	1.00	1.00	1.00
Income (tercile)					
Low (less than \$9,517)	1.96*	1.77*	1.63*	1.52*	1.38
Middle (\$9,517-\$18,799)	1.33	1.24	1.18	1.11	1.04
High (more than \$18,799)	1.00	1.00	1.00	1.00	1.00

SOURCE: Medicare Current Beneficiary Survey public use files, 1991 and 1992.

NOTES: All estimates were derived from equations using 7,303 subjects. Odds ratios were derived from three separate equations using each of the key sociodemographic variables in turn. Column 1 included no other variables; column 2 included access/prior use variables (usual source of care, supplemental insurance, and annual number of physician visits); column 3 included access/prior use variables, plus age and sex; column 4 included access/prior use variables, age and sex, and ambulatory diagnostic groups (ADGs); and column 5 included access/prior use variables, age and sex, and self-rated health and chronic disease risk score.

* $p < .05$

3). When ADGs from the ACG system were added, the relationship between income and preventable hospitalization was further diminished but remained substantial and statistically significant (column 4). Finally, when survey data, incorporating self-reported health status and history of chronic conditions, were used, the relationship between income and preventable hospitalization was no longer statistically significant (column 5).

To explore whether the relationships shown in Exhibit 3 might be driven by low-SES patients' having less stable sources of primary care, we again performed all analyses on the subset of patients who had a usual source of care and for whom that usual source was not a hospital emergency department. The findings shown in Exhibit 3 were essentially unchanged.

Discussion

This study found that 4 percent of community-dwelling Americans age sixty-five and over are hospitalized for an ambulatory care-sensitive condition each year. Poorer, sicker, and less-educated elders are more prone to these events.

Does the relationship between patient SES and preventable hospitalizations reflect patient factors, health system factors, or both? Variations in the likelihood of preventable hospitalization might reflect a number of underlying mechanisms. First, the greater burden of chronic disease and poor health accumulated over a lifetime by low-SES elders may make them more prone to these events. Our finding that adjusting for severity of illness could greatly diminish the relationship between low SES and preventable hospitalization suggests that this mechanism underlies much of the unadjusted relationship. However, other factors may be at work. Even under Medicare, lower-SES patients may experience poorer quality of care or diminished access to primary care. We tried to control for this possibility by including key access/prior use variables in our multivariate analyses and by performing sensitivity analyses on the subset of patients with a stable source of primary care. Still, access is complex and involves many dimensions of care, and our controls for access may have been incomplete. For example, we did not include data on access to pharmaceuticals, and Medicare does not pay for outpatient medications. Barriers to securing medications to control hypertension, diabetes, or congestive heart failure could have increased the likelihood of preventable hospitalization among poorer elders.¹⁴ To the extent that such barriers prevailed, residual differences in hospitalization rates by SES may reflect differences in access. Finally, the observed relationship between SES and preventable hospitalization might take place more directly. To the extent

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that lower-SES elders delay seeking care, or have poorer social supports and resources, hospitalization may be inevitable by the time that flare-ups of chronic disease come to medical attention.

Limitations and generalizability. The findings of this study are subject to numerous caveats. Probably the most important limitations pertain to the measures that were used. Some of these were based on self-reports, and others were derived from administrative records. To the extent that lower-SES elders are more likely to under-report medical conditions or to have fewer medical conditions coded in administrative records, the study may have overestimated the impact of being poor. Similarly, our measures of access were necessarily crude. To the extent that poorer Medicare beneficiaries experience (unmeasured) access barriers, differences in hospitalization rates could have been attributed to low SES in this study, when they should in fact have been attributed to differences in access and process of care. We are unable to ascertain the extent to which such biases might prevail in this secondary data analysis; clearly, further work is needed in this area.

Among other limitations, sample-size constraints prevented us from analyzing the determinants of each type of hospitalization separately. It is possible that hospitalizations for different syndromes are precipitated by different sorts of factors. Performing population-based studies of the determinants of hospitalization for particular syndromes would require a much larger sample than was available, and no such studies have been performed to date.

Can our findings be generalized to younger Americans? Within present health care financing arrangements, younger cohorts are more likely to include the uninsured and marginally insured, and for these groups, basic health care access may be problematic. Our findings do not invalidate earlier studies showing an increased risk of preventable hospitalizations among groups with poor access to primary care. However, the vast majority of Americans age sixty-four and younger do have health insurance, and most have a usual source of care. Although the chronic diseases that are prevalent in the elderly may be associated somewhat differently with the likelihood of hospitalization than those that prevail in younger populations, the findings of our study suggest that using preventable hospitalizations as indicators of health plan quality without proper adjustment is prone to substantial bias.

It might be argued that adjusting for SES in younger populations is unnecessary in light of the Medicaid Health Plan Employer Data and Information Set (HEDIS) and the program to separately assess plan performance with the Medicaid population. Although this may help, it is important to note that Medicaid participation and low SES do not necessarily coincide. For example, in 1995 only 46.2 percent of Americans living below the poverty level participated in Medicaid.¹⁵

Implications for performance measurement. This study does not resolve the issue of accountability for “preventable” hospitalizations, but we find it instructive to sketch out some policy implications under three hypothetical scenarios. Under the first of these, higher hospitalization rates among the poor reflect their poorer health (this could be called scenario 1). Under the second, higher hospitalization rates among the poor reflect the poorer care that they receive (scenario 2). And under the third, higher hospitalization rates among poorer persons reflect their diminished resources or less effective use of the health care system (scenario 3).

What are the implications of each of these scenarios for plan performance measurement? Under scenario 1, report cards should clearly be adjusted for severity of illness. Under scenario 2, case-mix adjustment is not warranted. But under scenario 3, what sort of adjustment would be fair? On the one hand, we might wish to case-mix-adjust for SES (not severity of illness) to acknowledge the link between SES, care-seeking behavior and resources, and the need for hospitalization. Adjusting for SES would encourage plans to take on difficult-to-reach populations without risk of penalty. On the other hand, there are good arguments for withholding case-mix adjustment for SES under scenario 3. After all, plans should be held accountable for developing systems of care that are appropriate to the populations they serve. To put it another way, excusing poor performance by plans that serve the poor will not encourage those plans to do better.

A few more observations can be made about the three scenarios. First, in reality, they are not mutually exclusive. Sometimes, all three causes (poor health, poor care, and diminished resources) act in concert to precipitate a preventable hospitalization. In other cases, a single cause predominates. Treating any of the three putative causes as the sole necessary condition for a preventable hospitalization risks failing to capture the complex clinical and social realities of medical care.

Second, the above comments apply to adjustment of performance measures and not necessarily to adjustment for reimbursement. Under scenario 3, for example, one might oppose adjustment of per-

“Quality-based competition will drive the provision of medical care; thus, measures of quality must be valid and fair.”

formance measures for SES but still favor a higher level of reimbursement to plans caring for poorer patients. After all, “reaching out” costs money. This is the stance taken by the British National Health Service, which gives general practitioners (GPs) a higher rate of reimbursement for caring for low-SES patients. The “deprivation payment” system is justified on the grounds that caring for low-SES patients consumes more of GPs’ time and resources.¹⁶

Third, it can be difficult to define where scenario 2 ends and scenario 3 begins, since accountability itself is problematic. We increasingly expect that providers will deliver “culturally appropriate” care. For example, if low-SES patients require monthly telephone calls from their providers to stay out the hospital, then we may expect providers to make a monthly call. But it is at least plausible that there is some point beyond which providers should not be held accountable. When poverty thwarts what would otherwise be effective health care, it may not be sensible or productive to look to the health care system for the solution.

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POLICYMAKERS AND BUSINESS LEADERS have reached a consensus that quality-based competition will drive the provision of medical care. It therefore is in the public interest that measures of quality be valid and fair. As HCFA’s hospital mortality experience demonstrated, failure to take into account the characteristics of patients can lead to the false attribution of poor-quality care to those providers who serve the nation’s most vulnerable populations. Our work adds to a growing body of evidence suggesting that the same issue is germane to developing indices of the quality of outpatient care. Severity measures for ambulatory care are in early stages of development, and these may ultimately prove to be helpful in making measures of performance more valid. However, as many others have pointed out, health plan data systems are as yet far from capable of supporting sophisticated severity adjustment. Moreover, as we have highlighted here, the more complex issue of adjustment for SES remains to be confronted. Further contributions by policymakers, managers, and researchers are needed to help resolve issues of accountability for health care processes and outcomes.

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NOTES

1. J. Hadley and E. Steinberg, "Access to Care in the Medicaid Program: Construction of Indicators of Access to Care from Diagnoses and Procedures of Hospitalized People and Preliminary Statistical Results," Technical Report 050-03 (Washington: Center for Health Policy Studies, June 1993).
2. See J. Billings and N. Teicholz, "Uninsured Patients in District of Columbia Hospitals," *Health Affairs* (Winter 1990): 158-165; J. Billings et al., "Impact of Socioeconomic Status on Hospital Use in New York City," *Health Affairs* (Spring 1993): 162-173; J.S. Weissman et al., "Rates of Avoidable Hospitalizations by Insurance Status in Massachusetts and Maryland," *Journal of the American Medical Association* 268, no. 17 (1992): 2388-2394; and P. Braveman et al., "Insurance-Related Differences in the Risk of Ruptured Appendix," *New England Journal of Medicine* 331, no. 7 (1994): 148-152.
3. A.B. Bindman et al., "Preventable Hospitalization Rates and Access to Care," *Journal of the American Medical Association* 274, no. 4 (1995): 305-311.
4. J. Billings, G.M. Anderson, and L.S. Newman, "Recent Findings on Preventable Hospitalizations," *Health Affairs* (Fall 1996): 239-249.
5. The terms *severity adjustment*, *case-mix adjustment*, and *risk adjustment* are often used somewhat loosely and interchangeably. In this paper we use only the first two. The former refers to the use of measures of the patient's underlying clinical state to facilitate valid comparisons of outcomes. The latter is a more generic term referring to the use of measures of any patient characteristic to facilitate valid comparisons of outcomes. Using this terminology, severity adjustment is a species of case-mix adjustment. In this paper we introduce another species of case-mix adjustment, adjustment for SES, which refers to the use of measures of patient SES to facilitate valid comparisons of outcomes.
6. Physician Payment Review Commission, *Annual Report to Congress, 1996* (Washington: PPRC, 1996).
7. See Health Care Financing Administration, Division of Survey Analysis, *Response Rates in the Medicare Current Beneficiary Survey* (Washington: U.S. Department of Health and Human Services, no date); D. Judkins and A. Lo, "Components of Variance and Nonresponse Adjustment for the Medicare Current Beneficiary Survey," in *Proceedings of the Section on Survey Research* (Chicago: American Statistical Association, 1992); and R. Apodaca et al., "Sampling from HCFA Lists," in *Proceedings of the Section on Survey Research*.
8. United Hospital Fund, Ambulatory Care Access Project, *Final Code Specifications for "Ambulatory Care Sensitive," "Referral Sensitive," and "Marker" Conditions* (New York: UHF, July 1991).

9. John Billings, Wagner School, New York University, personal communication, 3 November 1997.
10. See "Medicare Choices Selections Reveal Latest Thinking on Risk Adjustment," *Medicine and Health*, 6 January 1997, 1. Specifically, Ambulatory Care Groups Case-Mix Assignment software (PC version 3.01) was used. On the advice of Jonathan Weiner, one of the developers of the classification system, we used the ambulatory diagnostic groups (ADGs), rather than the ambulatory care groups (ACGs), to group the subjects. J.P. Weiner, Johns Hopkins University, personal communication, 21 February 1995. The thirty-four ADGs are nonmutually exclusive clinical categories that are described in J.P. Weiner et al., "Development and Application of a Population-Oriented Measure of Ambulatory Case Mix," *Medical Care* 29, no. 5 (1991): 452-472. Each subject was classified into all relevant ADGs, based on the ICD-9-CM codes recorded with each pertinent face-to-face "evaluation and management" encounter in 1991. Because there are many ADGs, we do not include details of analyses incorporating individual ADGs in the exhibits. Interested readers may obtain supplementary results from Jan Blustein, Wagner Graduate School, New York University, 4 Washington Square, New York, New York 10003.
11. Medical history was derived from questions in which subjects were asked whether they had ever been told by a physician that they had any of a list of conditions. From that list, the two clinicians involved with the project selected a subset that might reasonably be associated with ACS conditions, including arteriosclerosis (hardening of the arteries); angina pectoris or coronary heart disease; diabetes, elevated blood glucose, or glucose in the urine; emphysema, asthma, or chronic obstructive pulmonary disease; hypertension, sometimes called high blood pressure; myocardial infarction (heart attack); other heart conditions such as congestive heart failure, or problems with heart valves or arrhythmias; and stroke, or cerebrovascular accident. Because we are not aware of any validated method to aggregate information about medical history of this sort, we elected to simply total affirmative replies to assign an aggregate chronic disease risk score to each person. A similar approach has been used by other investigators. See J.B. Fowles et al., "Taking Health Status into Account When Setting Capitation Rates: A Comparison of Risk-Adjustment Methods," *Journal of the American Medical Association* 276, no. 16 (1996): 1316-1321.
12. G.S. Chulis et al., "Health Insurance and the Elderly," *Health Affairs* (Spring 1993): 111-118; and J. Blustein, "Medicare Coverage, Supplemental Insurance, and the Use of Mammography by Older Women," *New England Journal of Medicine* 332, no. 17 (1995): 1138-1143.
13. All analyses incorporated weights to reflect survey sampling and nonresponse. To accommodate the design effect from cluster sampling, SUDAAN software was used. Details of the multivariate analysis are available on request.
14. See, for example, S.B. Soumerai et al., "Effects of Medicaid Drug-Payment Limits on Admission to Hospitals and Nursing Homes," *New England Journal of Medicine* 325, no. 15 (1991): 1072-1077.
15. *Health Care Financing Review, Medicare and Medicaid Statistical Supplement, 1996* (Baltimore: HCFA, 1996), 372.
16. B. Jarman, "Identification of Underprivileged Areas," *British Medical Journal* (28 May 1983): 1705-1709.