Preventable Hospitalizations and Access to Health Care

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Objective.—To examine whether the higher hospital admission rates for chronic medical conditions such as asthma, hypertension, congestive heart failure, chronic obstructive pulmonary disease, and diabetes in low-income communities resulted from community differences in access to care, prevalence of the diseases, propensity to seek care, or physician admitting style.

Design.—Analysis of California hospital discharge data. We calculated the hospitalization rates for these five chronic conditions for the 250 ZIP code clusters that define urban California. We performed a random-digit telephone survey among adults residing in a random sample of 41 of these urban ZIP code clusters stratified by admission rates and a mailed survey of generalist and emergency physicians who practiced in the same 41 areas.

Setting.—Community based.

Participants.—A total of 6674 English- and Spanish-speaking adults aged 18 through 64 years residing in the 41 areas were asked about their access to care, their chronic medical conditions, and their propensity to seek health care. Physician admitting style was measured with written clinical vignettes among 723 generalist and emergency physicians practicing in the same communities.

Main Outcome Measures.—We compared respondents' reports of access to medical care in an area with the area's cumulative admission rate for these five chronic conditions. We then tested whether access to medical care remained independently associated with preventable hospitalization rates after controlling for the prevalence of the conditions, health care seeking, and physician practice style.

Results.—Access to care was inversely associated with the hospitalization rates for the five chronic medical conditions (R^2=0.50; P<.001). In a multivariate analysis that included a measure of access, the prevalence of conditions, health care seeking, and physician practice style to predict cumulative hospitalization rates for chronic medical conditions, both self-rated access to care (P<.002) and the prevalence of the conditions (P<.03) remained independent predictors.

Conclusion.—Communities where people perceive poor access to medical care have higher rates of hospitalization for chronic diseases. Improving access to care is more likely than changing patients' propensity to seek health care or eliminating variation in physician practice style to reduce hospitalization rates for chronic conditions.

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THE USE of small-area analysis to examine variations in hospitalization rates for chronic medical conditions has emerged as a potential measure of health care access.[1] Chronic medical conditions, such as asthma, diabetes, and hypertension, are conditions that can often be managed with timely and effective treatment in an outpatient setting, thereby preventing hospitalization. Hospitalizations for individuals with chronic medical conditions are likely to indicate an episodic or even potentially permanent decline in health status. Furthermore,

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the use of inpatient services rather than ambulatory care for managing chronic medical conditions may be more costly. Using hospital discharge data from several states, Caper[2] demonstrated that individuals living in low-income areas were more likely than individuals in high-income areas to be hospitalized for chronic medical conditions. In addition, Weissman et al[3] found that uninsured and Medicaid patients were more likely to be admitted to a hospital for chronic medical conditions than privately insured patients. The authors of these studies speculated that high hospitalization rates for chronic medical conditions might result from poor access to primary care and thus be preventable, since low-income and uninsured individuals are known to face barriers to care.[4-7] This interpretation is supported by a report that lack of a primary care clinician was the most significant reason for hospitalization for management of uncontrolled hypertension.[8]

Although small-area analysis of hospital discharge abstracts is a highly promising technique, its validity as a measure of health care access is not yet

well established. If validated as a measure of access to outpatient care, preventable hospitalization rates might provide local, state, and federal policymakers, as well as health care providers responsible for a defined population of patients, a method for measuring the effectiveness of outpatient care delivery. Admission rates for chronic medical conditions have already been included in some health plan report cards. Public health departments have targeted communities with high preventable hospitalization rates for interventions to improve access to ambulatory care.[9]

However, before this tool can be applied and interpreted with confidence, policymakers and health planners need to better understand what leads to high preventable hospitalization rates. At least three factors other than access barriers to health care may explain the relationship between income and preventable hospitalization rates: variations in disease prevalence, health care–seeking behavior, and physician practice style. For example, the prevalence of asthma is higher among the poor,[10] which could explain higher admission rates for this income group. Next, even without financial barriers to care, patients' responses to symptoms and other attitudinal and behavioral factors may differ according to socioeconomic status; patients who seek medical care later in the course of their disease may have missed the opportunity for their illness to be managed on an outpatient basis. Finally, physician practice style might explain the inverse relationship between high preventable hospitalization rates and low income in that physicians practicing in low-income areas could have a greater predisposition to hospitalize patients, based either on their clinical status or on social factors associated with low-income patients. To the extent that these other factors may explain preventable hospitalization rates, using admission rates to measure access to care may lead to faulty conclusions.

The main purpose of this study was to evaluate the extent to which access to care predicts preventable hospitalization rates in a community. We hypothesized that communities with residents who reported better access to medical care would have lower preventable hospitalization rates, even after controlling for variations in the prevalence of the underlying conditions, propensity to seek care, and physician practice style. We explored the relative importance of different access barriers in explaining preventable hospitalization rates in a community and whether these rates provided more information about access to care in a community than could be surmised from simply knowing the area's demographics and income.

METHODS

Our study analyzed data collected from multiple sources. We calculated small-area hospitalization rates in California using statewide hospital discharge data and census information. To measure access to care, disease prevalence, and propensity to seek care, we conducted a telephone survey of community residents in 41 communities. To assess physician practice style, we conducted a postal survey of physicians in the same 41 areas. We used 1990 US census information on age, gender, race, ethnicity, and household income characteristics of the sampled areas to supplement information in the community resident and the physician practice style surveys. In all cases, individual data were aggregated by taking the mean at the community level. We compared preventable hospitalization rates in an area with the reports of access, the prevalence of the conditions, propensity to seek care, and physician practice style. Prior to our performing the study, the project protocol was approved by the University of California, San Francisco, Committee on Human Research.

Preventable Hospitalization Rates

We performed our study in California communities that were defined by ZIP code clusters. These areas were made up of contiguous ZIP codes that corresponded to medical service study areas developed by California's Office of Statewide Health Planning and Development to monitor primary care resource availability.[11,12] We attempted to make these areas as demographically homogeneous as possible by examining the racial, ethnic, and income information available for each area from the 1990 census. We aggregated the 2656 ZIP codes in California into 394 ZIP code clusters, 250 of which were urban and 144 of which were rural. The median population of the ZIP code clusters was 52 000.

We calculated preventable hospitalization rates for all adults aged 18 through 64 years at a ZIP code cluster level from 1990 California hospital discharge[13] and 1990 census data. We did not include persons aged 65 years and older because previously reported work demonstrated that this population has much less variation in preventable hospitalization rates across income strata.[1] The numerator for these rates was the number of hospital discharges in each ZIP code cluster with a principal diagnosis of any of five specified chronic medical conditions: asthma, chronic obstructive pulmonary disease, congestive heart failure, diabetes mellitus, or hypertension. We also included cases of asthma and chronic obstructive pulmonary disease listed as secondary diagnoses, provided that the principal diagnosis was either pneumonia or acute bronchitis. We selected these conditions because we believed that they represented the clearest examples of adult chronic conditions that could benefit from outpatient treatment. The California hospital discharge database contains the patient's ZIP code of residence for all nonfederal acute care hospitalizations. Patients who travel out of state for hospitalization do not appear in the California discharge database. Because we believed that most out-of-state hospitalizations would have been within states bordering California—Oregon, Nevada, or Arizona—we searched the 1990 discharge databases of these states for California ZIP codes and incorporated those hospitalizations into our numerator counts. The denominator of the preventable hospitalization rate, the number of adults aged 18 through 64 years living in ZIP code–defined areas, was determined from 1990 census tract data aggregated to the ZIP code cluster level. (Census data were aggregated to the ZIP code level by Donnelly Information Marketing Services, Stamford, Conn.)

Community Resident Sample

Among the 250 urban ZIP code clusters, we selected a stratified random sample of 42 areas for in-depth analysis. Power calculations performed prior to the selection of our sample indicated that in a multivariate linear regression, 42 areas would give 0.80 power with two-sided α=.05 if we assumed that the model would explain 50% of the variance (as correlations with income suggested) and the access measure accounted for 10% of the variance. We randomly selected 14 areas from the top 15% of preventable hospitalization rates, 14 from the middle admission rate group, and 14 from the lowest 15%. Within each preventable hospitalization rate stratum, we selected seven above and seven below the median income for that stratum to ensure income variability.

Between April and July 1993, we surveyed a random sample of English- and Spanish-speaking adults between the ages of 18 and 64 years who had lived in the selected communities for a minimum of 3 months. The sample size for each ZIP code cluster was determined by the need to estimate disease prevalence. A minimum of 150 persons in each ZIP code cluster gave a 95% confidence interval of ±6% on the estimate of the prevalence of the five chronic conditions. Subjects were sampled using random-

digit telephone numbers generated from telephone exchanges that corresponded to at least 95% of the population in each of our study areas. The survey was administered by interviewers at the Field Research Corporation (San Francisco, Calif). At least 12 attempts were made to reach the household, and within each household, a potential respondent was chosen by random selection among eligible adults. One low preventable hospitalization rate ZIP code cluster was dropped from the sample because its poor match with telephone exchanges made it prohibitively expensive to sample. (Only 3% of random-digit telephone numbers generated with corresponding telephone exchanges actually reached a household in that ZIP code cluster because the area encompassed by those telephone exchanges greatly exceeded the targeted ZIP code cluster.) The overall response rate was 65.4%, and we completed interviews with 6674 adults.

Community Resident Data

Access to care in a community was determined from the community resident survey. We asked respondents closed-ended questions about their health insurance status, whether they had a regular source of care, and their self-rated access to care. Health insurance status was categorized as none, Medicaid, or other (96.1% of those classified as other had private insurance). Respondents who reported they had a regular place for health care were asked to describe the type of place. Individuals who identified an emergency department as their regular place were considered to have no regular place for care. A single self-rated item on access to medical care services asked subjects to rate on a 5-point scale their difficulty in receiving medical care when needed (Table 1).

We determined the prevalence of asthma, chronic obstructive pulmonary disease, congestive heart failure, diabetes, and hypertension in a ZIP code cluster in two ways. From the community resident survey, we summed the prevalence of the individual chronic medical conditions reported by respondents in an area. We counted conditions, not individuals, to correspond with our outcome measure, cumulative preventable hospitalization rates. Because we were concerned that a sample of 150 adults in an area might not lead to accurate estimates of the prevalence of the conditions, we also estimated the prevalence of these conditions using extrapolations of data in the 1990 National Health Interview Survey (NHIS).[14] We used NHIS reports of disease prevalence in the western region of the United States to identify several age, gender, race, and income strata, and the prevalence of the study conditions was then estimated for each ZIP code cluster based on the area's census demographic and income composition.

Propensity to seek care was estimated from the community resident survey. Respondents were asked how important they thought it was to see a physician for each of five major symptoms: chest pain, hemorrhage, syncope, unexpected weight loss, and dyspnea (Table 1).[15] We developed a propensity to seek care score that could range from 0 to 5 with 1 point assigned for each of the conditions, which respondents rated as either a little or not at all important; a higher score represented more underseeking.

For the 18- through 64-year-old population in each ZIP code cluster, we used information from the census to determine community populations' mean age, percentage male, percentage African American, percentage Hispanic, and the percentage of households with an annual income less than $15 000. We assessed educational level in the community resident survey.

Physician Practice Style

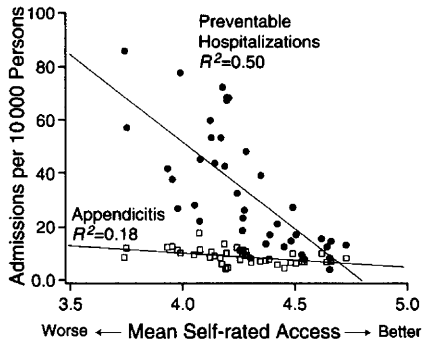
We measured physician practice style in the 41 target ZIP code clusters with a survey of providers of adult primary care (general internists, family physicians, and general practitioners) and emergency physicians.[16] Physician names and addresses were obtained from the American Medical Association (AMA) Physician Masterfile. The AMA Masterfile contains continuously updated information on physician address, specialty, and type of professional activity on all US allopathic physicians, including physicians who are not AMA members. Specialty assignment is based on the primary specialty area of practice as self-designated by each physician in the Masterfile. We surveyed all emergency physicians and either a total of 30 or 25% of the primary care physicians in the ZIP code cluster, whichever was larger. In addition, we assumed that community residents were more likely to visit emergency departments outside their ZIP code cluster than they were to visit primary care physician offices outside the cluster. Therefore, we used statewide hospitalization data to determine the main three hospitals where area residents were hospitalized; if these included a hospital located outside the ZIP code cluster, all emergency physicians located in the ZIP code of that hospital were also sampled. Physician practice location was based on the ZIP code of the physician's reported business address. In 54% of the areas, we surveyed all practicing general internists, family physicians, general practitioners, and emergency physicians. From the 1007 eligible physicians, we received 723 completed surveys (72%).

Table 1.—Study Instrument

Self-rated Access	
Overall, how difficult is it for you to get medical care when you need it? Would you say it is:	
Extremely difficult	1
Very difficult	2
Somewhat difficult	3
Not too difficult	4
Not at all difficult	5
Propensity to Seek Health Care	
How important would it be for you to see a doctor if you had:	
Weight loss of more than 10 pounds in a month when not dieting:	
Shortness of breath with light exercise or light work:	
Chest pain when exercising:	
Loss of consciousness, fainting, or passing out:	
Bleeding other than nosebleeds and not caused by accident or injury:	
Extremely important	1
Somewhat important	2
A little important	3
Not at all important	4

Our measures of self-reported clinical predisposition to hospitalize patients (clinical admission score) consisted of three series of clinical vignettes. In each series, a patient with an exacerbation of one of three chronic medical conditions (asthma, congestive heart failure, or diabetes) was portrayed in five vignettes of increasing clinical severity. After each vignette, the respondent was asked to decide whether the patient should be cared for as an outpatient or should be hospitalized. Each of the three series was scored by assigning the respondent a point for each decision to hospitalize the patient. The scores for the three series were then averaged to obtain a score between 0 and 5; the higher the clinical admission score, the greater the physician's reported propensity to hospitalize patients for the management of exacerbations of chronic medical conditions.

Physicians' self-reported responsiveness to social factors (social admission score) was designed to measure how strongly physicians' admission decisions were influenced by social factors that could increase patients' vulnerability to illness or lessen their ability to get further medical care. The patient's social factors were specified as having "no doctor for follow-up; alcoholic or IV drug user; known to be noncompliant; uninsured, cannot pay; homeless; lives alone; and has Medicaid."[16] For each scenario, the possible responses included five choices ranging from "much less likely



Hospitalization rates and self-rated access in urban California among individuals aged 18 through 64 years. Preventable hospitalizations indicate cumulative admission rates for asthma, chronic obstructive pulmonary disease, congestive heart failure, diabetes, and hypertension per 10 000 individuals in a ZIP code cluster. Appendicitis indicates admission rate for a condition with no known association with ambulatory care.

to admit the patient" through "much more likely to admit the patient." The scores for each of the seven social conditions were averaged to obtain a social admission score between 0 and 5; the higher the score, the greater the physician's propensity to hospitalize patients based on social factors. The psychometric properties of the physician clinical and social admission scores have been reported separately.[16]

Analysis

We hypothesized that areas with residents who had better access to medical care would have lower preventable hospitalization rates. To test this hypothesis, we performed regression analysis to examine the association of the mean self-rated access to medical care in an area with the area's preventable hospitalization rate. We examined the association of self-rated access with admission rates for each individual study condition as well as with the cumulative admission rate for all five conditions. To explore whether self-rated access to care was associated in a nonspecific fashion with hospitalization rates, we also examined its association with hospitalization rates for appendicitis, a condition for which we considered it extremely unlikely that variations in access to ambulatory care would affect the need for hospitalization.

To further validate that preventable hospitalization rates reflected access to care in an area, we predicted preventable hospitalization rates in regression analyses with other community measures of access to care, including the percentage insured by Medicaid, the percentage uninsured, and the percentage with a regular place for care. We performed multivariate regression analyses to test whether self-rated access to medical care remained independently associated with preventable hospitalization rates after we controlled for the prevalence of the conditions, the propensity to seek care score, and the clinical and social propensity of physicians in a given area to hospitalize. Finally, to ascertain whether preventable hospitalization rates reflected more than just the demographics and income of an area, we incorporated demographic and income data into a multivariate linear regression analysis predicting preventable hospitalization rates that also included the access measures, condition prevalence, propensity to seek care scores, and physician clinical and social propensity to admit scores. We examined whether our study design of oversampling high and low preventable hospitalization rate areas exaggerated measured associations by repeating our analysis a second time, weighting communities by their probability of being sampled from all 250 urban California communities.

Table 2.—Association of Access, Disease Prevalence, Propensity to Seek Care, Physician Practice Style, Demographics, and Income With Cumulative Preventable Hospitalization Rates*

Variable	Data Source	Mean (SD)	Univariate Association With Cumulative Preventable Hospitalization Rates: Coefficient	P	R^2
Access measures					
Self-rated access†	CRS	4.3 (1.1)	−64.8	<.001	0.50
% Uninsured	CRS	19.1 (10.4)	0.9	.005	0.19
% Medicaid	CRS	4.5 (4.4)	3.5	<.001	0.47
% Regular place‡	CRS	80.8 (8.2)	−1.5	<.001	0.29
Condition prevalence§	CRS	25.7 (6.4)	2.4	<.001	0.44
	NHIS	24.7 (2.5)	5.2	<.001	0.32
Propensity to seek care‖	CRS	0.7 (0.1)	57.9	.15	0.03
Physician admitting style					
Clinical admission score¶	PS	2.9 (0.4)	4.0	.65	0.01
Social admission score¶	PS	3.6 (0.2)	−3.1	.87	0
Demographics and income					
Age, y	Census	37.9 (2.5)	−1.1	.43	0.02
Gender (% male)	Census	51.7 (4.4)	−1.9	.02	0.14
% African American	Census	11.4 (16.6)	0.9	<.001	0.43
% Hispanic	Census	26.4 (21.8)	0.3	.06	0.09
High school education or less, %	CRS	39.2 (21.0)	0.7	<.001	0.42
Income <$15 000, %#	Census	21.0 (10.2)	1.8	<.001	0.64

*Cumulative preventable hospitalization rates are per 10 000 population. NHIS indicates National Health Interview Survey–derived estimates based on age, gender, race, and income; CRS, County Resident Survey; and PS, Physician Survey.
†On a scale of 1 to 5, 1 indicates most difficulty with access; and 5, least difficulty.
‡Percentage of individuals in an area reporting a regular place for medical care.
§Asthma, chronic obstructive pulmonary disease, congestive heart failure, diabetes, and hypertension per 100 people.
‖On a scale of 0 to 5, 0 indicates least underseeking; and 5, most underseeking.
¶On a scale of 0 to 5, 0 indicates least propensity to admit; and 5, most propensity.
#Percentage of households in an area with a reported annual income less than $15 000.

RESULTS

Among the 41 sampled areas, there was more than a fourfold difference in admission rates between the high and low preventable hospitalization rate areas. The median cumulative hospitalization rate for the five studied chronic conditions ranged from 13 per 10 000 in the 13 low preventable hospitalization rate areas to 59 per 10 000 in the 14 high preventable hospitalization rate areas. Across the 41 areas, self-rated access to care was high, with the majority of ratings skewed toward not having difficulty receiving care when it was needed. Community-level access scores ranged from 3.7 to 4.7 (mean, 4.3) on the 5-point scale. The community self-rated access was inversely associated with the cumulative preventable hospitalization rates, and this variable alone explained 50% ($P<.001$) of the variation in the rates across the areas (Figure). An area's admission rate for each of the individual study conditions was also significantly associated with the area's self-rated access: asthma, $R^2=0.47$; congestive heart failure, $R^2=0.50$; chronic obstructive pulmonary disease, $R^2=0.27$; diabetes mellitus, $R^2=0.46$; and hypertension, $R^2=0.22$ ($P<.002$ for all comparisons). In contrast, only 18% ($P<.01$) of the variation in the rates of admission for appendicitis, a condition with no known association with outpatient care, was explained by self-rated access to care in these areas.

Self-rated access to care was significantly associated with several other mea-

sures of access to care in a ZIP code cluster. Self-rated access to care was lower in areas with greater proportions of uninsured (R^2=0.73; P<.001) and Medicaid-insured (R^2=0.61; P<.001) persons. Conversely, self-rated access to care was higher in areas with a greater proportion of individuals with a regular place for care (R^2=0.81; P<.001).

Consistent with our hypothesis about the relationship between access to care and preventable hospitalization rates, admissions were higher in ZIP code clusters with higher proportions of uninsured and Medicaid patients (Table 2). Preventable hospitalization rates were lower in areas where a greater proportion reported a regular place for care.

Next we examined whether non–access-related variables, including condition prevalence, propensity to seek care, and physician practice style, explained variation in preventable hospitalization rates. The prevalence of the five study conditions estimated from the survey ranged from 14.5 per 100 to 41.2 per 100 (mean, 25.7 per 100) across our study areas. As expected, preventable hospitalization rates were higher in areas with higher prevalence of the underlying chronic medical conditions. Estimates of the prevalence of chronic medical conditions in our study areas from the community resident survey and the NHIS data were similar (R^2=0.62). The mean of the estimates of the prevalence of chronic medical conditions for each ZIP code cluster based on NHIS calculations explained 32% of the variation in cumulative preventable hospitalization rates in our study areas in univariate regression analysis.

In general, there was little propensity to underseek health care for serious symptoms. The propensity to seek care scores ranged across the areas from 0.5 to 0.9 on the 0- to 5-point scale, and they were not associated with the area's preventable hospitalization rate.

The mean clinical admission score of physicians in the study areas was 2.9 and the mean social admission score was 3.6 on the 0- to 5-point scales. There was no association between the preventable hospitalization rates and the clinical admission score or social admission score across the 41 areas, indicating that even though variation in physician practice style existed across areas, it did not explain variation in preventable hospitalization rates.

In a multivariate analysis that included self-rated access, disease prevalence, propensity to seek care, and physician admitting style as predictors of cumulative preventable hospitalization rates, both self-rated access to care and the prevalence of the underlying chronic medical conditions remained independently significant (Table 3).

Table 3.—Multivariate Association of Access to Care, Condition Prevalence, Propensity to Seek Care, and Physician Admission Scores With Cumulative Preventable Hospitalization Rates*

Variable	Association With Cumulative Preventable Hospitalization Rates	
	Coefficient	P
Self-rated access†	−54.9	.002
Condition prevalence‡	117.1	.03
Propensity to seek care§	−23.8	.50
Clinical admission score‖	−5.9	.40
Social admission score‖	−3.1	.90

*Cumulative preventable hospitalization rates are per 10 000 population. Adjusted R^2=0.57.
†On a scale of 1 to 5, 1 indicates most difficulty with access; and 5, least difficulty.
‡Asthma, congestive heart failure, chronic obstructive pulmonary disease, diabetes, and hypertension per 100 people as measured on community resident survey.
§On a scale of 0 to 5, 0 indicates least underseeking; and 5, most underseeking.
‖On a scale of 0 to 5, 0 indicates least propensity to admit; and 5, most propensity.

To examine whether preventable hospitalization rates were sensitive to components of self-rated access that were independent of demographics, income, and insurance status, we performed a multivariate analysis as shown in Table 4. Because self-rated access measure was highly correlated with the percentage of residents reporting a regular place for care (R^2=0.89), these two measures were not included simultaneously in a model. Even with the strong relationships between preventable hospitalization rates and the proportion of African Americans, income and education, self-rated access remained independently associated with preventable hospitalization rates in the full multivariate model (Table 4). When we substituted the proportion of residents with a regular source of care into the model for mean self-rated access, it too was significantly and inversely associated with preventable hospitalization rates in the full multivariate model, and there were no significant changes in the coefficients or P values of any of the remaining variables (data not shown). In both models, the percentage of uninsured residents in an area, which in univariate analysis was *positively* associated with preventable hospitalization rates, was *inversely* associated with preventable hospitalization rates in the multivariate model. The reversing of the sign for the insurance variable between the univariate and the multivariate models did not appear to be due to colinearity among independent variables in the multivariate model. To test for the potential impact of colinearity, we performed several stepwise multiple regression models to predict preventable hospitalization rates in which we forced insurance in the model with income, education, race, or disease prevalence variables. The addition of any of these covariates to the model reversed the sign of the insurance variable from positive to negative without significantly affecting the SE estimate of the insurance variable (data not shown).

Table 4.—Multivariate Association of Access to Care, Condition Prevalence, Propensity to Seek Care, Physician Admission Scores, Demographics, and Income With Cumulative Preventable Hospitalization Rates*

Variable	Association With Cumulative Preventable Hospitalization Rates	
	Coefficient	P
Access measures		
Self-rated access†	−44.0	.01
% Uninsured	−1.5	.01
% Medicaid	−0.2	.80
Condition prevalence‡	−0.5	.20
Propensity to seek care§	9.8	.70
Physician admitting style		
Clinical admission score‖	−1.3	.80
Social admission score‖	−2.7	.80
Demographics and income		
Age, y	1.6	.20
Gender (% male)	−0.1	.90
African American	0.3	.04
Hispanic	−0.2	.50
High school education or less, %	0.8	.001
Income <$15 000, %¶	1.0	.01

*Cumulative preventable hospitalization rates are per 10 000 population. Adjusted R^2=0.84.
†On a scale of 1 to 5, 1 indicates most difficulty with access; and 5, least difficulty.
‡Asthma, congestive heart failure, chronic obstructive pulmonary disease, diabetes, and hypertension per 100 people as measured on community resident survey.
§On a scale of 0 to 5, 0 indicates least underseeking; and 5, most underseeking.
‖On a scale of 0 to 5, 0 indicates least propensity to admit; and 5, most propensity.
¶Percentage of households in an area with a reported annual income less than $15 000.

When we repeated our regression analysis with communities weighted by their probability of being sampled, the amount of variation explained in our multivariate model decreased minimally from 0.84 to 0.82, and there was no significant change in the significance or in the relationships among the independent variables.

COMMENT

Individuals living in areas where residents had difficulty receiving medical care had high rates of preventable hospitalizations for chronic medical conditions. The association of self-rated access, as well as the percentage of residents with a regular place for care, with preventable hospitalization rates supports the assertion that these rates are a valid measure of health care access. This strong relationship between access and preventable hospitalization rates

persists even after controlling for differences in demographics, income, the prevalence of the study conditions, the propensity to seek care, and physician admitting practice styles. Hospitalization rates for appendicitis, a condition that cannot be prevented or treated with outpatient care, had little association with self-rated access to care across areas. These findings indicate that preventable hospitalization rates may be a useful index of access to medical care.

We believe that many individuals who have difficulty receiving outpatient care experience a deterioration of their health that results in a preventable hospitalization. Self-rated access to care was lower in communities with greater proportions of uninsured residents, Medicaid beneficiaries, and persons without a regular place for care. Other barriers to outpatient care were related to African-American race and poverty, which were also significant predictors of preventable hospitalization rates even after controlling for differences in the prevalence of the conditions, propensity to seek care, and physician practice style across areas. Preventable hospitalization rates may be greater in poor or minority areas because these areas have more individuals who experience a clinical deterioration in their health or because these areas have more individuals who require hospital admission for social reasons. Although these same demographic factors could possibly also impede access to inpatient care, the deterioration in health related to a lack of outpatient care most likely creates a need for acute care that overwhelms the potential access barriers to hospital care. Interestingly, in univariate analyses, the association in an area between the percentage of uninsured and the preventable hospitalization rate was positive. However, once other factors associated with the uninsured and with hospitalization rates, such as disease prevalence and low income, were included in the model, the association in an area between the percentage of uninsured and preventable hospitalization rates changed so that higher percentages of the uninsured were associated with lower preventable hospitalization rates. We suspect that this reflects the barrier the uninsured face in receiving inpatient care and that even when acutely ill, the uninsured may experience greater difficulty in receiving inpatient care compared with privately insured patients. A systematic review of emergency department use might reveal that the uninsured are more likely to receive treatment for chronic medical conditions in this location without being hospitalized.

The fact that practice style did not explain variation in preventable hospitalization rates suggests that efforts using guidelines or incentives to reduce individual physician discretion and uncertainty about the decision to hospitalize patients with these chronic conditions are unlikely to be effective in reducing preventable hospitalizations.

Our analysis was limited to urban areas in California, and the association of health care access and preventable hospitalization rates may differ in rural areas. We oversampled areas at the extremes of preventable hospitalization rates and therefore may have overestimated the strength of the association between reports of access to care and preventable hospitalization rates. The preventable hospitalization rates that characterized our ZIP code clusters were based on 1990 hospital discharge data, while the survey data on access to care were collected in 1993. It is possible that hospitalization rates or individuals' reports of access could have changed over the interim, giving us a misleading impression of the relationship between access and preventable hospitalization rates.

Our assessments of access to care, prevalence of chronic conditions, and propensity to seek health care were limited to patient self-reports. Medical care access is probably best measured from the patients' perspective, since provider reports and medical charts will not contain information on patients who do not receive care. Only individuals with a home telephone were included in our sample. The vast majority of Californians have a telephone, and individuals without one tend to be of lower socioeconomic status.[17] Since these people are more likely to experience difficulties with access to care, including individuals without telephones in our sample most likely would have further strengthened our results. Our estimates of the prevalence of the chronic medical conditions were limited by the small sample sizes in each study area; however, an independent method of estimating the prevalence of chronic conditions using the NHIS produced similar findings. Our disease prevalence measures did not capture potential differences in disease severity across areas that might have explained some variation in preventable hospitalization rates. We might have found more variation and explanatory power of preventable hospitalization rates in our measure of propensity to seek health care had we included more minor symptoms, but less serious symptoms are less likely to require hospitalization, even if it is difficult to receive care for them. More research is needed to validate measures of health care–seeking behavior, and we recommend the development of condition-specific measures to conclusively determine the role of health care–seeking behavior in explaining variation in preventable hospitalizations.

In 1990, California discharge data did not contain individual identifiers that would enable a researcher to detect repeated hospitalizations for the same patient. If significant numbers of readmissions occurred, as might be expected among individuals with poor access to care, this would tend to exaggerate the association between measurements of health care access and preventable hospitalization rates.[18] Coding errors have the potential to undermine the use of preventable hospitalizations as an access to care indicator; however, audits of California discharge data have found it to be quite reliable.[19] The wide availability of hospital discharge and census data makes preventable hospitalization rates easy to calculate; however, the time lag in receiving the data for analysis may limit its relevance for policy evaluation. For example, in California there is a delay of 18 to 24 months between an actual hospitalization and the availability of those data for analysis. Electronic claims processing should decrease this lag time in the future and enable health planners to have more timely access to the data.

For health policymakers and planners who would like to incorporate preventable hospitalization rates in health plan quality report cards,[20] we recommend caution. Our finding that demographic characteristics and insurance status also affect the preventable hospitalization rates suggests that it would be unreasonable to compare providers or health plans on the basis of these rates without accounting for these differences in the patient population. More research is needed to determine the stability of the preventable hospitalization rates in an area or a health plan over time and how these rates vary in response to well-defined changes in the health care system, such as the openings and closings of clinics or increases and decreases in health care spending. Having performed an ecological analysis at the population level, we cannot rule out the possibility that an unmeasured factor in our study communities is responsible for both higher rates of preventable hospitalizations and lower perceptions of access to care. Our area-level analysis has not shown that improving access to care for individuals with these conditions would absolutely lower their hospitalization rate. The next step to prove the causal association between access to care and preventable hospitalizations is to study individuals with chronic medical conditions to determine whether those who have im-

provements in their access to health care have a lower probability of hospitalization. The addition of individual identifiers to discharge databases, as is now occurring in some states,[21] should enhance the understanding of how improving access to care for an individual affects that person's risk for hospitalization over time. Nonetheless, at a community level there is a strong positive association between health care access and preventable hospitalization rates, suggesting that these rates can serve as an indicator of access to care and health outcomes in evaluations of programs and policies.

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