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Factors Influencing Rural Residents' Utilization of Urban Hospitals

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Abstract

Objective—To examine, using nationally representative data, which patient, hospital, and county characteristics influence rural residents' urban hospitalization.

Methods—Rural residents hospitalized in urban hospitals (crossovers) are compared with those hospitalized in rural hospitals (noncrossovers). National Hospital Discharge Survey data were merged with Area Resource File and Centers for Medicare & Medicaid Services data to study rural inpatients' characteristics; hospital descriptors; and county or state socioeconomic and health service variables. Multivariate logistic regression analysis identified covariates of the likelihood of being a crossover.

Findings—About one-third of the rural resident hospitalizations in 2003 were in urban hospitals. Other factors constant, those requiring greater resources had higher odds of crossing over, as did younger inpatients, those transferred from other hospitals, receiving surgery, and with mental diagnoses or congenital anomalies. Males, emergency admissions, and intervertebral disk disorder inpatients had lower odds of crossing over compared with those who were not in these categories. Crossover patients' hospitals had higher Medicare case mix indices than hospitals used by noncrossovers. Rural inpatients in government hospitals, rather than proprietary or non-profit hospitals, had greater odds of crossing over, as did rural patients from counties with lower population density, fewer hospital beds, more hospitals, more commuters, and lower per capita income compared with those in other categories.

Conclusions—Rural hospitals continue to be an important source of inpatient care, but rural residents travel to urban hospitals in some specific instances.

Keywords: inpatients • National Hospital Discharge Survey • hospital choice • hospital bypassing

Introduction

In the 1980s, rural hospitals were closing at an alarming rate, and this trend continued, though at a slower pace, during the 1990s (1). Loss of a rural community's hospital, particularly if it is the sole hospital, not only affects access to inpatient care, but also to outpatient, 24-hour emergency room, and long-term care, as well as other services the hospitals provide to community residents. The supply of physicians and other health care professionals may also dwindle in areas without hospitals.

To help preserve access to hospital care for rural residents, the Medicare program established a number of special inpatient reimbursement categories for rural hospitals (1,2), which were designed to help rural hospitals overcome the financial hurdles they face primarily due to their low volume. But, even with these programs, rural hospitals can maintain financial viability only if a sufficient number of residents in their communities receive their inpatient care locally rather than elsewhere (3). Information on the number and characteristics of rural residents who remain in, and those who leave, rural areas for hospitalization is important for rural and urban hospitals, for policymakers, and for payers.

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The phenomenon of leaving rural areas to be hospitalized has been the subject of prior research spanning a number of years and has been referred to as out-of-area hospitalization, out-migration, and bypassing local hospitals. In this study, we refer to rural patients whose hospitalization takes place in urban hospitals as ''crossovers'' and others as ''noncrossovers.''

During the 1980s, nearly 30 percent of rural Medicare beneficiaries were treated in urban hospitals (4), and during the 1990s the average was 32 percent (5). The stability of these numbers was surprising given changes in hospital care during that time period, including increases in managed care enrollment and multihospital chains (5).

Two multivariate analyses of national data on rural Medicare beneficiaries were conducted—one using fiscal year 1987 data (4) and the other 1994–1995 data (3). Both found that Medicare beneficiaries who were younger, male, had cardiovascular or psychiatric conditions, needed surgery, or had greater or specialized resource needs were more likely to be hospitalized in an urban hospital over a rural hospital. The 1987 study (4) found that Medicare disabled patients, and those who had more diagnoses, and the 1994–1995 study (3) found that those with longer patient or physician ties, were more likely to obtain hospital care locally. The later study found that, although rural Medicare beneficiaries in general were more likely to be hospitalized in hospitals closer, rather than farther, from their residences, those who had higher income, more education, and who had a previous admission within a year to a nonlocal hospital were more likely to bypass their closest rural hospitals.

Other smaller studies (6–11) in specific geographical areas found that many of the same variables were important in what they refer to as hospital choice. Included among these was distance from an urban area. In addition, some studies found county hospital resources and types of hospitals chosen were important variables to consider (8,12–14). Most notable about these smaller studies was the great variation in the percentages of rural patients who crossed over—from 18% to 64% for various locations (6,7,12). Importantly, some of these studies assessed the effects of different types of health insurance on being a crossover.

By including national data for patients covered by all payers, this study is the first to attempt to determine the proportions of rural hospitalized patients who go to rural and urban hospitals, and the factors that may influence the decision to crossover for both Medicare and non-Medicare patients. It also utilizes more recent data, and includes data on characteristics of patients, the hospitals in which they are hospitalized, and attributes of the counties and states where they live.

Methods

Conceptual framework—Hospital choice literature

The factors found to influence hospital choice can be grouped into patient characteristics, physician's referral patterns, hospital characteristics, and county characteristics. National data on most of these major categories were included in this analysis with the exception of physician factors. The only variable included for physicians was a measure of physician supply in the patient's county of residence.

Patient characteristics considered important included demographic characteristics, clinical factors, length of hospital stay, whether an admission was on an emergency basis or was a transfer from another hospital, and source of payment. Payment source could directly affect hospital choice, as in the case of health maintenance organizations (HMOs) or managed care, by limiting coverage to certain hospitals that are owned by, or have contractual arrangements with, the managed care plan. But fee-for-service (FFS) coverage could also affect choice of hospital if coverage was more generous for hospitals listed on a preferred provider list. The terms under which hospital care is covered could effectively encourage or discourage crossing over to urban areas for inpatient care by requiring patients using certain hospitals to pay more out of pocket, or incur more debt, than those who used others.

Hospital characteristics of importance included the scope and level of services offered by hospitals (9,15), actual or perceived hospital quality (8,12,13,16) and, not previously included in other known national models, hospital ownership. Hospital policies relating to care not covered by insurance could vary by ownership, so this variable could provide important information about barriers affecting hospital choice.

A county characteristic deemed important in prior studies was proximity, or ease of access to urban areas (7,10). Other county-level demographic characteristics, like population density and socioeconomic status, play an important role because of their potential influence on the ability of the local area to offer and support more specialized services. County health service variables provide valuable contextual information about how resource rich or poor the rural resident's county is.

Lastly, state certificate of need (CON) programs could be an important influence on the extent to which regionalization of services is encouraged, and hence on the number of crossover hospitalizations.

Data

This research used the 2003 National Hospital Discharge Survey (NHDS), consisting of 319,530 randomly sampled discharges from a national probability sample of 426 nonfederal, short-stay or general hospitals conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics. Data on infants born during the sampled hospitalizations were excluded from the analysis. Because persons with multiple hospital discharges in a year can be sampled more than once, NHDS produces estimates for discharges, not persons. Throughout this report the terms discharges, patients, and inpatients are used interchangeably. A full description of the survey has been

published elsewhere (17). Of the overall number of NHDS discharges, 33,434 hospital discharges of rural county residents were analyzed for this report.

Using ZIP Codes from NHDS internal files, we identified hospital and patient Federal Information Processing Standards (FIPS) county codes. All of the hospitals had a ZIP Code, but these codes were missing for 2% of the patients. These patients were dropped from the analysis because urban or rural designations were needed for both the patient's county of residence and the county of the hospital in order to determine whether or not a patient was a crossover patient. After having identified counties for NHDS patients and hospitals included in this study, the June 2003 Office of Management and Budget (OMB) classification of counties (18) was used to assign an urban or rural status. Counties identified by the OMB classification to be metropolitan were considered to be urban, and all others (micropolitan and noncore counties) were considered to be rural. We also merged NHDS data with contextual demographic and health services data on the patient's county of residence from the 2005 Area Resource File (ARF) (19). The 2005 ARF generally contains data from 2003. Data on commuting patterns to urban areas from the University of Washington (20) were also merged with the NHDS data.

We also augmented the NHDS file with two files from the Centers for Medicare & Medicaid Services (CMS). The first one contained data on payment weights for each Diagnosis Related Group (DRG). The DRG for each patient stay had already been added to each NHDS discharge but, using this first CMS file, we were able to add the DRG payment weight to each record indicating the level of resources used during the hospital stay.

To the NHDS file we also added data from a second CMS file containing case mix index (CMI) scores for each hospital. These scores were calculated by CMS for each hospital by averaging the DRG weights for Medicare patients served in a year. This measure gives a relative indicator of the level of specialized care offered by a hospital. Out of the 426 NHDS hospitals, 56 did not have a CMI index on the CMS file. For 47 of these hospitals, 2005 CMI scores were obtained from the American Hospital Directory (http://www.ahd.com). For the remaining nine hospitals, CMI scores were calculated by averaging the DRG weights of discharges included in the NHDS with Medicare payment or, if there were no Medicare patients, those with all payment sources. We tested this method by comparing the CMIs of hospitals obtained from the CMS file to the CMIs calculated using the method just described. Results were highly correlated (Pearson's r=0.79).

Finally, a measure of state-level Certificate of Need (CON) stringency was obtained from Popescu et al., 2006 (21), who based it on the 2000–2003 National Directories of Health Planning Policy and Regulatory Agencies and the work of Conover and Sloan (22).

Independent variables

Patient characteristics

Demographic characteristics of hospitalized rural residents analyzed in this study included sex, race, and age. Patients' principal expected payment source was categorized as Medicare, Medicaid, private insurance, health maintenance organization or preferred provider organization (HMO or PPO), self-pay, or other. Private insurance was used as the reference category in the logistic model.

Clinical characteristics were measured using a number of different data items. One was whether or not the admission to the hospital was an emergency. These data were obtained from the admission type variable in the NHDS, which included five choices: emergency, urgent, elective, newborn, and not available or unknown. Newborns were excluded from this study. For this analysis, patients in the emergency category were compared with all others (including the 9% with no stated admission type). Other data were obtained from the admission source item in NHDS. The admission source item has response categories of physician referral, clinical referral, HMO referral, transfer from a hospital, transfer from a skilled nursing facility, transfer from other health facility, emergency room, court or law enforcement, other, and not available. For this study, those patients transferred from a hospital were compared with all others (including the 6% with the "other" or "not available" admission sources).

Also included in the model were dummy variables indicating whether or not patients had a first-listed diagnosis of ischemic heart disease, mental disorders, childbirth, intervertebral disc disorders, conditions originating in the perinatal period, or congenital anomalies. These diagnoses were identified from relevant research literature (4–6), or from initial bivariate analysis of the NHDS data (23,24), which indicated that they were correlated with crossover status.

We used a summary indicator of the number of comorbidities, such as diabetes or heart failure, which was computed using the Charlson Index as adapted by Deyo et al (25). Scores range from 0 to 16, with higher values indicating greater patient comorbidity burden and treatment complexity. As described earlier, the DRG weight obtained from CMS files was linked with patients' DRGs already included on the NHDS file. Higher DRG weights would indicate greater relative resource use for that particular hospitalization. The DRG also included information indicating whether or not a patient received surgery.

Hospital characteristics

In addition to classification as urban or rural, hospital characteristics included teaching status as an indirect measure of quality (16) and ownership (for-profit or proprietary, government, or not for profit). Federal hospitals are not included in the NHDS so the government category included state, county, and city or town ownership. Not for profit was used as the reference category in the logistic regression.

The Medicare 2003 CMI for hospitals is based on the average DRG weight of the hospitals' Medicare patients. Hospitals with higher CMI indices have Medicare patients with

higher resource requirements with the implication that they provide more sophisticated equipment and specialized care. We assume that a hospital's Medicare CMI index would be representative of all its patients. As described earlier, CMI index values were imputed for nine of the 426 hospitals. In the logistic model, scores on the CMI were divided into five groups based on quintiles using the weighted distribution of the values: very high, high, middle, low, or very low. Quintiles were used because of the skewed distribution of the values for this variable for the hospitals in this study. The ''high'' group was used as the reference category.

County and state characteristics

The share of the rural resident's county population that commuted daily to an urban county for work was obtained from the University of Washington (20) and was used as a proxy for accessibility of the urban area (i.e., closer in distance or time or both). A higher proportion of daily commuters from a county to an urban area is considered to indicate greater accessibility.

The ARF provided socioeconomic data for the counties where the rural inpatients lived, including county population density, percentage of residents with a college education, and per capita income. ARF measures of health service resource availability included rate of active nonfederal physicians (excluding doctors of osteopathy) per 1,000 population; number of short-term general (STG) hospitals in the county; rate of STG hospital beds (set up and staffed) per 1,000 population; whether or not the county had a rural referral center (which more closely resembles an urban hospital in patients, staff, and service types), and the rate of HMO penetration in 2003.

Because hospital choice could be influenced by state restrictions on provider provision of services (e.g., through CON programs) we included a previously developed measure (21) of no, low, or high CON program stringency. The reference group for the logistic regression was no CON program.

Statistical analysis

Sampled data were weighted to produce national statistics. Differences between crossovers and noncrossovers on the variables, or subcategories of variables, contained in Table 1 were tested using the two-sided *t*-test. The significance level indicated in Table 1 was the 0.05 level. All error estimates were derived from SUDAAN, which accounts for the complex sampling design of the NHDS (26).

In addition to descriptive analyses, multivariate logistic regression tested the likelihood of a hospitalized rural resident being a crossover (1) compared with a noncrossover (0). We analyzed groups of variables in steps, adding each group sequentially in four separate regressions, in order to estimate the portion of the variance that was explained by patient, hospital, county, and state variables.

Collinearity among the variables included in the model was checked using Pearson's r and, in general, the level of correlation was low. The bedsize variable was highly correlated with teaching hospital (r=.62) and CMI index (r=.76) and so bedsize was dropped from subsequent models. Some other variables included in descriptive analyses were dropped from the final multivariate model because they were not statistically significant and their exclusion did not alter other effects. One measure, length of stay, was excluded because it was found to be endogenous to the dependent variable based on a Durbin-Wu-Hausman test (27). A few variables without independent effects were retained because of their conceptual importance or to allow comparability with other research results.

Results

Descriptive analysis

In 2003, 7.3 million rural residents in the U.S. were hospitalized in short-stay hospitals. Most of these, 68 percent or 4.9 million inpatients, used rural hospitals. The other 2.4 million (32%) were crossovers to urban hospitals. Table 1 presents a description of these rural inpatients by their crossover status, including demographic and medical characteristics, as well as hospital, county, and state characteristics. Because of low reliability, estimates with relative standard errors of more than 30 percent, or that are based on fewer than 30 records, are not presented in this table.

This analysis shows that patients with certain characteristics were significantly more likely to be crossovers, that is, males, younger patients, those with higher DRG weights, with a surgical DRG, hospitalized for ischemic heart disease, and those transferred from another hospital. Patients with an expected payment source of Medicare were significantly less likely to be crossovers. One hospital characteristic was also found to be statistically significant. Patients in hospitals with higher Medicare CMIs were more likely to be crossovers. Lastly, some characteristics of the counties where inpatients lived were statistically significant. Crossovers were more likely to live in counties with lower per capita income and with a lower rate per 1,000 population of short-term general hospital beds.

Multivariate analysis

Table 2 provides adjusted odds ratios for variables in four logistic regression models. Model 1 shows patient characteristics only, Model 2 adds hospital characteristics, Model 3 adds characteristics of patients' county of residence, and the final model, Model 4, adds state-level CON regulation. The results of the final, most comprehensive, model (Model 4) will be discussed in this section. Changes in effects that occurred across the bivariate and the four multivariate models will be included in the discussion.

Looking at the final model (Model 4), several factors distinguished between crossovers and noncrossovers after controlling for other variables. With regard to patient attributes, female

patients and those who were younger had higher odds of being crossovers than male and older patients. Patients with a surgical compared with a nonsurgical DRG, a higher rather than a lower DRG weight, those hospitalized for mental disorders or congenital anomalies (compared with those with other diagnoses), and those who had been transferred from another hospital rather than coming from other or unknown admission sources also had higher odds of being crossovers. Emergent patients, compared with those with other and unknown admission types, and those hospitalized for intervertebral disk disorders, had lower odds of being crossovers.

In terms of hospital characteristics, other things held constant, crossovers had higher odds of being treated in hospitals with higher rather than lower CMI scores, and in government hospitals rather than not-for-profit hospitals.

A number of county characteristics resulted in higher odds of being a crossover. Patients living in counties with a larger number of short-term general hospitals, and those with a larger percentage of the population commuting to work in urban areas, had higher odds of being crossovers controlling for other factors. Those who lived in counties with a greater population density, higher per capita income, and a higher rate of short-term general hospital beds per population, had lower odds of being a crossover compared with those in other counties.

Taken alone, patient characteristics explained 17 percent of the variability in the dependent variable according to the pseudo R-squared value. Adding the hospital-level variables accounted for an additional 43 percent of the variance for a total of 60 percent. After adding in the patient's county socioeconomic and health services characteristics the percentage of the variation explained was 71 percent—an increase of 11 percent. The inclusion of the single state-level variable, CON stringency, did not add much to the multiple R-squared for this model. Though conceivably the contributions of the different sets of variables would have changed if entered into the model in a different order, we chose the above order because it matched our conceptual framework (in which the patient's needs are the origin of the hospitalization decision) and other studies that added variables in a similar order, and because using a different order did not appreciably alter the results.

Discussion

In this section, we primarily discuss significant findings from our final model (Model 4), which included patient, hospital, county, and state variables. We also discuss changes in the pattern of results as we moved from bivariate to multivariate analyses.

Patient characteristics

About two-thirds of rural patients were hospitalized in rural hospitals. This percentage is similar to that found in earlier national studies (4,5) of rural Medicare patients (Table 1).

Younger patients had greater odds of crossing over to urban hospitals than older patients, consistent with prior national and regional studies (3,4,7,10,14,28). Older patients have been found to have more impediments to travel, including unwillingness to travel to urban areas for hospitalization (7,8,11,28).

Our bivariate findings and prior research (4,14) indicated that males were significantly more likely to be crossovers than females. But in our multivariate analyses this held only in Model 1, which included only patient characteristics. Controlling for county characteristics (Model 3), we found the reverse, that males had lower odds of crossing over than females. Thus some of the higher prevalence of crossing over among males found in other studies appears to have been due to uncontrolled variation at the county level. Those hospitalized for intervertebral disc disorders (IDD) had lower odds of crossing over in Models 1, 3, and 4. This suggests that local access to IDD treatment varies by county and that these patients stayed local when possible.

Unlike previous research (9,11,28) we did not find that being a black rural resident was associated with using a rural rather than urban hospital. Other variables in our model may account for effects formerly thought to be due to race. It is also possible that missing race data for 20% of the discharges, or the relatively small numbers of rural black patients included in the NHDS, could have influenced these findings.

Having greater resource needs (average DRG weight) and receiving surgery increased the odds of crossing over. Clinical variables, particularly those designed to measure the need for specialized care, have been established as important predictors in numerous other studies (4–8,28). We found significant effects on being crossovers of patients with congenital anomalies after county characteristics were included in the multivariate analyses (Model 3). There was no prior literature studying the effects of this diagnosis on crossing over.

Our bivariate analyses found that those hospitalized for ischemic heart disease (IHD) were more likely to be crossovers. The literature also found having heart disease or cardiovascular surgery was positively related to crossing over (4–6). In our multivariate analyses, however, after hospital characteristics were added (Models 2–4), IHD was no longer statistically significantly related to being a crossover. It may be that the receipt of care in hospitals with high case mix indices, which some IHD and other patients require, was actually what appeared to raise the odds of being a crossover in the absence of hospital covariates.

On the other hand, being hospitalized for mental disorders and being an emergent patient were each not statistically significant in bivariate analysis, or in Models 1 or 2, but were included in further models because of literature supporting their importance. When county characteristics were added (Models 3 and 4), both having a mental disorder and being an emergent patient were associated with being a crossover though in different directions. Patients with mental disorders were more likely

to be crossovers, and emergent patients were less likely to be crossovers. For mental disorders, researchers have speculated these effects were due to psychiatric care being less available in rural areas (29), and to the desire for anonymity one may be more likely to get in an urban hospital (7,30). Other research on emergent patients noted that the immediacy of these patients' need for hospitalization removes much, if not all, of the choice of hospital (6).

Transferred patients were found to have greater odds of crossing over (Model 4). This finding suggests that the first hospital (which may or may not have been rural) could not provide all of the care the patient needed (29).

In our bivariate findings, Medicare patients were significantly less likely to be crossovers. Prior research from selected states and local areas found that those with private insurance were more likely to cross over (6), and that those who were uninsured (self-pay) (6,9), or on Medicaid (9), were less likely to crossover. However, none of the payment sources exerted a statistically significant independent effect in our multivariate analyses. It is understandable that the observed bivariate effect of Medicare would not hold up in the multivariate context, where we controlled for age (Medicare patients are predominantly aged 65 years and over). This study not only included data on insurance coverage, but also controlled for characteristics of the hospitals where crossovers received care (including hospital ownership that may be related to offering uncompensated care), and for county and state variables. The effects of less comprehensive private health insurance offered in rural areas (31,32) could also have affected our findings. This issue is addressed further below along with managed care findings.

Hospital characteristics

Unlike in prior research (10), we did not find that patients in teaching hospitals were significantly more likely to be crossovers, either in our bivariate or multivariate analyses. Patients in hospitals with higher hospital CMIs, however, had consistently greater odds of being crossovers in bivariate and multivariate analyses (Models 2–4). Other similar measures of the level of specialized care offered were positively related to crossover status in prior research (1,8), suggesting that the level of specialized care offered is responsible for crossing over to urban areas rather than teaching status per se.

Hospitalization in a government, compared with a nonprofit, hospital was associated with significantly greater odds of being a crossover in Models 2–4. There are no known prior national studies assessing the effects of hospital ownership on being a crossover, but one explanation could be that government hospitals are more likely to offer relatively unprofitable services that are disproportionately needed by poor and underserved patients, and are thus considered the caregivers of last resort (33). A 2005 U.S. Government Accountability Office study (34) found that government hospitals often devoted substantially larger shares of their patient operating expenses to uncompensated care than other types of hospitals. Rural residents are more likely to be self-employed, work for small employers, and have lower wages and more limited benefits, including less comprehensive health insurance (31,32). This underinsurance and government hospitals' commitment to offering uncompensated care could explain why crossovers had greater odds of being hospitalized in government facilities.

County characteristics

Living in a county with a larger proportion of commuters to urban areas was significantly associated in multivariate Models 3 and 4 with increased odds that patients would crossover for hospitalization. Other studies have found that various measures of distance and accessibility to hospitals were important influences (7,10). The commuter result may also demonstrate rural residents' comfort with traveling to the city.

Rural patients living in counties with higher per capita income had lower odds of being crossovers in prior research (28), in our bivariate analysis, and in our multivariate models. The result for higher per capita income could indicate that the county would have the ability to raise the initial funds needed to bring in physicians and other specialized resources, and enough people with the comprehensive insurance to cover this care afterwards. When individual income, rather than county per capita income, has been studied, however, those with higher income have been found to be more likely to crossover (3).

A higher county population density was also associated with decreased odds of crossing over for hospital care. A certain population density would be required to create sufficient demand to support the provision of specialized services locally. Furthermore, rural hospitalized residents with more STG hospital beds per capita in the counties where they lived were significantly less likely to be crossovers in our bivariate analysis, and had lower odds of crossing over to urban areas than those in counties with fewer of these beds in Models 3 and 4. This finding, supported by other research (28), may be because more beds per population increased the likelihood that hospitals would specialize and thus offer more sophisticated care locally. On the other hand, patients in counties with a higher number of STG hospitals (at a constant level of beds per capita) had greater odds of crossing over than those in counties with fewer hospitals. This may suggest that instead of offering more specialized services, a greater number of STG hospitals may indicate many smaller hospitals offering basic services in a larger number of local communities. Information on the size, dispersion, and level of sophistication of hospitals should be taken into account in future analyses to see if this, indeed, is the case.

Just as individually being enrolled in an HMO or PPO was not statistically significant in our analyses, neither was living in a county with a higher penetration of managed care. Prior studies on the effects of HMO and other managed care coverage on crossing over had conflicting results (6,9,28).

Managed care has been slow to spread to rural areas (35) and, where it does exist, may have fewer restrictions to encourage provider participation, which may make it more similar to unmanaged care.

We did not attempt to determine which patients ''should'' have crossed over to receive the most appropriate care. In our data, we only know which patients did cross over. It is possible that one or more of the barriers to access that were discussed previously in this paper resulted in some patients not being able to get more specialized care in urban areas. Knowing the extent to which this occurs would be useful in assessing rural access to care and represents a fertile area for future inquiry.

By examining in turn patient, hospital, county, and state variables, this research not only considered a larger number of variables than most studies of hospital choice, but it also provided some indication of the relative importance of each of the categories. The majority of the variance was explained by characteristics of the hospitals where care was given. Hence, prior studies that did not include hospital characteristics may have missed a vital component of the process and could have yielded incomplete, and possibly misleading, results.

Limitations of this study include the fact that patients who were hospitalized more than once during a year could have been sampled for the NHDS more than once. Such a person could have been a crossover for one hospitalization and a noncrossover for another. These discharges could be within the same episode of illness (e.g., when a rural patient started in a rural hospital and transferred to an urban hospital), or when more time separated the hospitalizations. However, data on all sampled hospitalizations are included here and provide valuable information about each distinct stay.

Some of the NHDS variables used in this analysis had missing values. A specific admission type was missing for 9% of the discharges and a specific admission source for 6%. Twenty percent of NHDS discharges had race missing. Prior research on race underreporting in the NHDS (36) found that hospitals that did not report race were likely to have a higher proportion of white discharges than hospitals that reported race. Nonetheless, some of the records with race not stated would have been for black patients and this, combined with the relatively small numbers of rural black patients included in the NHDS, could contribute to our failure to detect an independent effect of race that some prior studies had found. We felt that failure to include data on race in the model would have been a far more serious shortcoming.

Hospital choice is in actuality a more complex and dynamic process than our, or other models in the literature, suggest. A patient's condition is what leads to a referral for inpatient care in the first place, and so patient characteristics are included in analyses of this issue. It is probable that what the patient needs, and the hospitals they or their physicians feel are able to meet those needs, are the most important influences in selecting where to go for inpatient care. A rural patient with complex needs may only be able to receive specialized care by crossing over to an urban hospital. In cases where the patient's needs can be met in either a rural or urban hospital, other factors (such as patient preferences to stay near home) may play a more prominent role.

In addition, the extent to which an individual patient really has a choice varies. The set of facilities from which a patient could 'choose' might be limited to only one, or only a few, in terms of the link between services needed and services provided, advice of providers, insurance coverage, and availability of beds. In emergencies, the need for immediate care could effectively limit the choice to the closest facility. Because this is a study of hospital discharges, we do know that some choice was made, and the patient, physician(s), emergency care providers, or family (or likely several of these) took part in the decision-making process.

In this and most other studies on this topic, no data were included on availability of public and other transportation to urban areas, travel costs, out-of-pocket costs, and additional time off from work (often unpaid) for patients or their family members if hospitalization took place in an urban area. Further, little data exist on physicians' and families' influence on the choices made, patients' assessments of the quality of care of various hospitals, indicators of cultural and ethnic viewpoints, or other personal views likely to influence hospital choice, all of which should be explored in future research.

Conclusions

Early studies identified the elderly, the needy, and the disabled as the groups likely to be the most adversely affected by rural hospital closures, because these patients were less likely to travel to urban hospitals for inpatient care. In an attempt to maintain local access to hospital care for the most vulnerable, as well as other rural residents, multiple federal programs were enacted to ease the financial burden on rural hospitals. These programs were largely targeted to areas where hospital closure would present a hardship for the residents (e.g., in the case where there is only one hospital in the community).

Even with this financial assistance, rural hospitals could not have continued to operate if a sufficient number of rural patients did not use them for care. Most hospitalizations of rural residents are indeed in rural hospitals. The third of the rural resident hospitalizations that occur in urban hospitals are more likely to involve specialized levels of care that are not offered in most rural hospitals.

Some rural counties, those with more people and greater financial means, have specialized care in their own local hospitals. But less densely populated rural counties, and those with lower average incomes, are not likely to have the resources to support specialized hospital care locally (8). Without an increase in the rate of hospital beds per population, having more hospitals may improve access to basic services closer to home, but more hospitals does not necessarily mean greater access to

hospitals with specialized care in rural areas. Residents of these areas have, and probably will continue to have, higher odds of crossing over to urban hospitals.

Greater coordination between rural and urban hospitals is important so referrals are easily arranged. Improvements in the provision of transportation, and the means to pay for it, would eliminate another barrier to ensuring equal access to urban hospital care (37). At a broader level, federal or other programs to expand coverage for the uninsured and the underinsured could help ensure access to profit, not-for-profit, and government urban inpatient hospital care. Some states have already begun to offer programs to expand coverage by providing financial incentives for insurers to offer it, and residents to buy it (38).

It is possible that an important factor responsible for the extensive use of rural hospitals is that patients prefer to receive care closer to home. But these hospitals' ability to attract a substantial share of inpatients is contingent upon rural residents and their doctors continuing to believe that these rural hospitals offer the care they need, and that this care is of comparable quality to what they would get in urban hospitals. Due to pressure from federal agencies, private employers, consumers, and health care professionals, rural hospitals, often as part of networks, have followed the lead of larger hospitals in gathering and analyzing data on the quality of care, and in using these data to continuously monitor and improve their performance (39). The legislation that established the critical access hospital program requires these small rural hospitals to meet certain quality standards and provides funds for quality-related activities (40,41). Without these quality assessment and improvement efforts, rural hospitals could run the risk of losing patients who decide that the inconvenience of traveling to urban areas for hospital care is outweighed by the better care and outcomes they anticipate receiving if they were hospitalized in larger, more sophisticated, high-tech hospitals.

The Patient Protection and Affordable Care Act (P.L.111–148), and the Health Care and Education Reconciliation Act (P.L.111–152), both passed in 2010, are expected to have far-reaching effects on the health care system and on access to, and quality of, care in both rural and urban areas. It will be important to track the effects of these laws on rural residents' hospitalization in rural and urban areas.

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Table 1. Descriptive data on rural residents who were hospitalized in urban hospitals (crossovers) and those who were hospitalized in rural hospitals (noncrossovers), United States, 2003

Variables	All rural residents' hospitalizations N = 7,292,000		Crossovers N=2,357,000		Noncrossovers N=4,935,000	
	Estimate	SE	Estimate	SE	Estimate	SE
Patient characteristics						
Demographic characteristics						
Male (%)**	42	0.6	47	0.7	40	0.7
Average age (in years)**	57	0.8	52	1.3	59	1.0
Black (%)	6	1.8	8	2.0	*	*
Diagnostic and other clinical characteristics						
Hospitalized for (first-listed diagnosis) (%)						
Ischemic heart disease**	8	0.6	11	1.0	6	0.7
Mental disorder	6	1.1	6	1.4	6	1.5
Childbirth	8	0.7	8	1.1	7	0.8
Intervertebral disc disorder	1	0.2	2	0.3	*	*
Condition originating in the perinatal period	0.4	0.1	1	0.2	*	*
Congenital anomaly	0.4	0.1	1	0.2	*	*
Surgical DRG (%)**	26	1.7	43	1.8	18	1.5
Average DRG weight**	1.16	0.03	1.51	0.04	1.00	0.02
Average Charlson/Deyo comorbidity index	1.06	0.04	1.05	0.05	1.07	0.06
Administrative characteristics						
Expected source of payment (%)						
Medicare**	51	1.3	42	1.6	56	1.7
Medicaid	14	1.0	16	1.3	13	1.2
Private insurance	19	1.1	22	1.5	18	1.4
HMO or PPO	8	1.3	10	1.3	6	1.7
Self pay	4	0.3	4	0.5	4	0.4
Other or not stated	4	0.5	6	1.0	3	0.7
Emergent (percent)	29	2.6	23	1.8	31	3.6
Transferred from another hospital (%)**	4.4	0.9	11	1.8	1	0.4
Hospital characteristics						
Teaching hospital (%)	8	1.9	21	3.4	*	*
Ownership (%)						
Not-for-profit	73	5.7	67	5.7	75	8.0
Government	14	4.2	21	5.0	*	*
For-profit	*	*	13	2.8	*	*
Medicare case mix index (average)**	1.26	0.03	1.35	0.02	1.22	0.05
County characteristics						
County demographic and socioeconomic characteristics (average)						
Population density per square mile	60	7.4	56	5.6	62	10.4
Percent in county commuting to urban area for employment	12	1.3	13	1.3	11	1.7
Percent with a college degree	15	0.6	14	0.7	15	0.8
Per capita income**	22,400	351	21,400	333	23,000	466
County health service characteristics (average)						
Rate of active MDs per 1,000 population	1.2	0.09	1.0	0.08	1.2	0.13
Number of short-term general hospitals	1.7	0.17	1.6	0.19	1.7	0.21
Rate of short-term general hospital beds per 1,000 population**	3.6	0.29	2.9	0.15	3.9	0.41
Percent HMO penetration	9	1.2	8	0.7	9	1.8
Percent had rural referral center	17	4.2	14	1.9	*	*
State characteristics						
Certificate of need program (%)						
None	51	7.8	52	9.7	50	10.3
Low stringency	34	8.5	30	8.1	36	11.8
Medium or high stringency	*	*	*	*	*	*

** Difference significant at 0.05 level using a *t*-test.

* Figure does not meet standards of reliability or precision. Estimates with a relative standard error of more than 30 percent, or that are based on a sample size of fewer than 30 records, are considered to be too unreliable to report.

NOTE: N is the weighted estimate and SE is standard error.

SOURCE: 2003 National Hospital Discharge Survey, National Center for Health Statistics, Centers for Disease Control and Prevention.

Table 2. Multiple logistic regression results on factors associated with rural patient crossover to urban hospitals: United States, 2003

Selected characteristics	Model 1	Model 2	Model 3	Model 4
Patient characteristics		Odds ratio		
Sex: male	**1.16	0.93	**0.86	**0.86
Age	**0.98	**0.98	**0.97	**0.97
Black	1.45	2.12	1.40	1.40
Average DRG weight	**1.53	**1.20	**1.26	**1.26
Average Charlson/Deyo comorbidity index	**1.06	0.98	0.96	0.96
Surgical DRG	**2.37	**1.56	**1.62	**1.60
Emergent admission	0.84	0.69	**0.61	**0.60
Transferred from another hospital	**9.13	**6.72	**6.41	**6.35
Hospitalized for:				
Ischemic heart disease	**1.82	1.27	1.37	1.35
Mental disorder	1.61	2.90	**4.33	**3.98
Intervertebral disc disorder	**2.26	0.68	**0.62	**0.64
Childbirth	1.11	1.21	1.11	1.13
Congenital anomaly	1.68	2.62	**5.37	**5.98
Condition originating in perinatal period	1.19	3.29	4.03	4.48
Expected source of payment:				
Medicare vs. private insurance	1.00	1.18	1.28	1.31
Medicaid vs. private insurance	0.93	0.97	0.94	0.94
HMO or PPO vs. private insurance	1.20	0.79	0.90	0.96
Self pay vs. private insurance	1.04	0.90	0.92	0.97
Other or not stated vs. private insurance	1.57	1.61	1.23	1.24
	pseudo R^2 = 0.17			
Hospital characteristics				
Teaching hospital	...	0.18	0.38	0.40
Ownership				
Profit vs. nonprofit	...	1.33	1.41	1.63
Government vs. nonprofit	...	**5.62	**6.16	**6.34
Medicare Case Mix Index (CMI)				
Very low vs. high	...	**0.07	**0.03	**0.03
Low vs. high	...	**0.02	**0.01	**0.01
Middle vs. high	...	**0.14	**0.05	**0.05
Very high vs. high	...	**32.59	**35.55	**35.12
		pseudo R^2 = 0.60		
County-level characteristics				
Demographic and socioeconomic characteristics				
Population density per square mile	...	...	**0.99	**0.99
Percent commuting to urban area for employment	...	...	**1.08	**1.08
Percent with a college degree	...	...	1.06	1.07
Per capita income	...	...	**0.82	**0.81
Health services characteristics				
Rate of active MDs per 1,000 population	...	...	**1.33	1.29
Number of short-term general hospitals	...	...	**1.63	**1.54
Rate of short-term general hospital beds per 1,000 population	...	...	**0.72	**0.74
Had rural referral center	...	...	0.90	0.93
HMO penetration	...	...	0.96	0.96
			pseudo R^2 = 0.71	
State-level characteristics				
Certificate of Need Program				
Low stringency program vs. no program	...	...	...	0.60
Medium or high stringency program vs. no program	...	...	...	0.84
				pseudo R^2 = 0.71

** Significant at the 0.05 level.

... Category not applicable.

SOURCE: CDC/NCHS, 2003 National Hospital Discharge Survey.

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