Why Urban Voluntary Hospitals Close

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In this paper, we argue for the importance of understanding hospital closings and relocations. Broad descriptive data on closings, relocations, and other reconfigurations of beds in 52 large and mid-size U.S. cities are presented. The period covered is 1937 to 1980.

Two contrasting outlooks on hospital closings and relocations are offered. As hypothesized, smaller and less specialized nonteaching hospitals and those located in minority neighborhoods or serving above-average proportions of minority or Medicaid-funded patients were more likely to close. A potentially more effective but more costly and less accessible system of urban health care appears to result.

In most large American cities, the rapid post-war growth in the number of urban voluntary hospitals and the beds they operated slowed during the 1970s. Many cities experienced net reductions in both hospitals and beds—voluntary, public, and proprietary—for the first time.

Although slow increases in overall bed-to-population ratios continue, there are several reasons for concern over the pattern and pace of voluntary hospital closings and relocations in growing numbers of cities. These reasons lie in the types of hospitals that closed or relocated, the types of sites they left, the characteristics of the patients they served, the nature of the forces influencing closure, and the impact of their departures. There is reason to fear that observed patterns of closings and relocations reflect—and exacerbate—the evolution of this nation's urban health care toward more costly but less equally accessible services.

This paper presents selected findings from a continuing study of urban hospital closings, relocations, and other reconfigurations. It singles out voluntary hospitals for two reasons. First, they now provide almost

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four-fifths of the acute care in the cities studied, almost three-fourths of care received by minority or Medicaid-funded patients, and perhaps as much as three-fifths of care for patients expected to lack insurance [1]. Second, they lack the tax resources of the public sector and the profit-motivation of the proprietary sector, so their ability and willingness to provide health care in rapidly changing central cities help to illuminate the prospects for equal, affordable, and effective hospital care.

Especially at a time of increasing pressure to cut public spending on health care, monitoring hospital closings provides a useful indicator of institutional distress. Documentation of the changes in the configuration of urban hospital services—institutions' ownership pattern, average size, intensity of care, and location—indicates many of the directions in which hospital care is evolving. Studying current behaviors against a background of several decades makes it easier to decide if there is greater cause for concern about what is observed today. If changes in configuration are large, it would be particularly important to understand their causes and impacts. Further, understanding the causes of closings/relocations should permit early identification of institutions unlikely to survive. This would allow time for advance planning to save needed hospitals. A sketch of major reconfigurations in urban hospital care over the past four decades helps to indicate why closings and relocations are important; it also provides background for the analyses which follow.

HOSPITAL RECONFIGURATION, 1937–1980

All of the nonfederal short-term acute care hospitals in 52 large U.S. cities (Appendix A) were followed from 1937 to 1980. Both continuity and instability can be observed in examining hospital bed-to-population ratios, ownership, bedsize, average size, and closings and relocations during this period.

One result of all changes made by public, proprietary, and voluntary nonprofit hospitals has been an increase of slightly over three-fifths in the total number of beds. The overall bed-to-population ratio increased from 4.73/1000 residents in 1937 to 6.50 in 1980, a rise of 37.4 percent. The number of beds per 1000 increased during each decade and in all groups of cities, even those experiencing population losses. (In the larger Northeast and Midwest cities, which lost 3.1 percent of their 1970 beds by 1980—a slight rise in voluntary beds here was more than offset by a decline of one-fourth in public beds—a 12.9 percent drop in total population led to an increase in the bed-to-population ratio of about 10.0 percent.) Overall, the Standard Metropolitan Statistical Areas (SMSAs) of the cities studied had

a bed/population ratio of 4.08/1000 in 1970; this increased to 4.32/1000 in 1980.

Thus, while the central cities appear markedly overbedded by either the traditional Hill-Burton level of 4.50 or the more recently entertained ratio of 4.00 [2], the entire SMSAs do not appear badly overbedded even by the more conservative measure. A net reduction of only 7.4 percent in the total number of beds operated in 1980 would result in 4.00 beds/1000 in the 52 SMSAs.

Although the total number of acute care beds increased by about three-fifths from 1937 to 1980, marked declines were noted in the public sector. The number of beds under nonfederal public control declined both absolutely and proportionately. A net loss of over 12,000 beds—more than one-quarter—was recorded during this period. In the eighteen large Northeast and Midwest cities, almost two-fifths of all public beds were closed from 1960 to 1980 alone. Overall, the public share fell from about one-third of short-term beds in 1937 to one-seventh in 1980 (Table 1).

For a time, this decline may have been appropriate, as the need for local public hospitals to care for the uninsured diminished after World War II due to the expansion of private health insurance and the enactment of Medicare and Medicaid. Today, with cuts in public third-party payment, rising unemployment, and the unavailability of adequate numbers of nursing home beds for lower and moderate income chronically ill citizens, the need for public hospital care is again rising. But local governments find it difficult to match the slowest growing tax—the property tax, their principal revenue source—against the fastest growing type of expenditure—hospital care [3].

Proprietary hospital beds grew at the fastest rate between 1937 and 1980, but did so from a very small base. The number of beds operated for a profit declined in the large Northeast and Midwest cities. Increases were noted in a few large Southern and Western cities, particularly Los Angeles and Houston, and in many smaller cities and affluent suburban areas. Proprietary institutions, customarily lacking deep community roots, and of smaller-than-average size, were by far the most likely to close.

The number of voluntary, nonprofit beds almost doubled during the study period and rose from less than two-thirds to almost four-fifths of the total. This increase fell off markedly during the 1970s, when it slowed to about one-third the rate of the preceding three decades.

The increase of voluntary beds took place despite the closing or relocating of 210 hospitals, a number equal to 42.2 percent of those open in 1937 (Table 2). The number and proportion of hospitals closing or relocating have risen steadily from decade to decade. There were 498 voluntary hospitals of 50 or more beds in 1937 in the 52 cities studied;

Table 1: Voluntary, Proprietary and Public Acute Care Hospital Beds, All Cities, 1937–1980[a]

	A. Beds				*B. % of Total*			
Year	*Voluntary*	*Proprietary*	*Public*	*Total*	*Voluntary*	*Proprietary*	*Public*	*Total*
1937	94,306	4,329	47,514	146,149	64.5%	3.0%	32.5%	100.0%
1950	115,216	4,449	52,592	172,257	66.9	2.6	30.5	100.0
1960	141,287	6,293	51,516	199,096	71.0	3.2	25.9	100.0
1970	175,717	9,553	44,200	229,470	76.5	4.2	19.3	100.0
1980	187,607	15,317	35,020	237,944	78.9	6.4	14.7	100.0

	C. % of Change in Beds, Past Decade				*D. % of Change in Beds, from 1937*			
Year	*Voluntary*	*Proprietary*	*Public*	*Total*	*Voluntary*	*Proprietary*	*Public*	*Total*
1937	—	—	—	—	—	—	—	—
1950	22.2%	2.8%	10.7%	17.9%	22.2%	2.7%	10.7%	17.9%
1960	22.6	41.4	(2.0)	15.6	49.8	45.4	8.4	36.2
1970	24.4	51.8	(14.2)	15.3	86.3	120.7	(7.0)	57.0
1970	6.8	60.3	(20.8)	3.7	98.9	253.8	(26.3)	62.8

Source: Physicians Record Company *Directory* (1937) and AHA *Guides* (1950–1980).

[a]Hospitals of less than 50 beds are excluded.

Table 2: Voluntary Hospitals Closing, Relocating, Surviving, and Originating, All Cities, 1937–1980

Period	*Initial Hospitals*[a] *Open*	*Closures and* −*Relocations*	*%*[b] =	*Survivors*	*%*[b] +	*New Hospitals* =	*Ending Hospitals*[c] *Open*
1937–50	498	(27)	(5.4%)	467	94.6%	43	518
1950–60	518	(45)	(8.7%)	473	91.3%	78	552
1960–70	552	(59)	(10.7%)	492	89.3%	82	584
1970–80	584	(79)	(13.5%)	496	86.5%	29	527
1937–80	498	(210)	(42.2%)	274	—	232	527

Source: Physicians Record Company *Directory* (1937) and AHA *Guides* (1950–1980).

[a]Short-term voluntary general and other special hospitals of 50 or more beds in the cities studied.

[b]Of the hospitals open at beginning of period.

[c]Rows do not add because small numbers of hospitals change to and from voluntary status.

their number peaked at 584 around 1970, and fell to 527 in 1980. (In the older, large Northeast and Midwest cities, the number of voluntary hospitals peaked around 1960 and had fallen in 1980 to a level 10.0 percent below that of 1937. It continues to decline.)

Hospitals closing or relocating took with them a number of beds equal to about one-third of those open in 1937 (30,663 of 94,306). Unexpectedly, fully two-thirds of the gross increase in voluntary beds was due to additions to existing hospitals (82,562 of 123,964), and only one-third, to construction of new facilities, generally on cities' growing peripheries. The closing and relocating of smaller hospitals and the growth of those surviving combined to increase average voluntary hospital size by 83.5 percent, from 194 beds in 1937 to 360 in 1980. Further, the concentration of voluntary beds in hospitals with major medical school affiliations increased markedly. In 1950, only 9.3 percent of hospitals (with 18.6 percent of the beds) had major affiliations; this increased to 32.1 percent of hospitals (and 46.2 percent of beds) in 1980.

VIEWS OF HOSPITAL BEHAVIOR

Two very different general outlooks on the causes and impacts of urban voluntary hospital closings/relocations are possible. One is that they are generally natural, reasonable, and benign, and help to reshape a city's hospitals in desirable ways. The other is that they are products of dangerous trends both in health care and in our society, and exacerbate problems in the configuration and cost of urban hospital care.

The first might hold that hospitals close or relocate because of appropriate competition. Thus, "competition" in the provision of urban health care is thought possible, sufficiently present, and desirable. Badly managed hospitals or those disliked by patients or physicians (because they were in the wrong areas or failed to provide needed services or desired amenities) would be most vulnerable to closing, especially if located in a city with too many beds. According to Whalen:

> Thus far, hospital closures have generally been consistent with the Darwin Theorem: the fittest survive, the weakest die. Generally speaking, closed hospitals are those which were obsolete, unsafe, unneeded, underutilized, and/or below standard. [4]

The contending view holds that the reasons for most closings have been as inappropriate as their impacts have been undesirable. Most urban hospitals have indeed always competed (and our nation's health care system has for some time been one of the most competitive in the world [5]), but few of the elements required for free or perfect price competition have been present, so it is difficult a priori to applaud as socially desirable the works of this invisible hand. Were something approaching free market competition possible in health care, and were it to act in benign ways, allocation of existing resources might be efficient. But, even then, it would reflect prevailing inequalities in the distribution of health care purchasing power in the society. These inequalities are believed to help explain the observed pattern of hospital closings/relocations.

Our review of past work in this field [6], in combination with conversations with hospital administrators and health planners, generally inclines us toward the second perspective on hospital behavior. We hypothesize that, in most instances, hospitals serving larger proportions of uninsured, minority, or Medicaid-funded patients—or located in neighborhoods in which many such potential patients reside—face greater risks of closing. Within this group, we hypothesize that hospital closings, relocations, and survival principally reflect certain characteristics of the institutions themselves and of their physicians. The pattern of hospital care which results is believed to be potentially more effective, but less affordable and accessible.

Hospital closings or relocations have not generally led to reduced bed-to-population ratios, even in cities thought to be badly overbedded. Indeed, hospitals have been slightly likelier to close in the less overbedded cities and metropolitan areas. This unexpected finding immediately calls into question the appropriateness of hospital behavior and strengthens the need to understand it.

The impacts of changes in hospital configuration on access, cost, and

effectiveness of care can be difficult to measure directly. In particular, it is difficult to follow patients displaced by a closing or relocation to learn how their circumstances have changed. A better understanding of the reasons hospitals close may inform judgments on their desirability.

HOSPITAL CHARACTERISTICS

Major institutional variables thought to be associated with survival are size, goals, and financial status. Among hospitals serving the poor, larger teaching hospitals are believed to be more willing to remain open in central cities for several reasons. Downtown locations are accessible from throughout the metropolitan area, allowing suburban patients to seek specialty care. At the same time, they are convenient to medical school faculty members who supervise students and residents and admit large numbers of their own private patients to teaching hospitals. Such locations also permit continued care to lower income urban residents—the patients most teaching hospitals were founded to serve and who probably continue, disproportionately, to be regarded as "teaching material."

Large teaching institutions serving the poor are also hypothesized to find it easier to remain open in central city locations than smaller community hospitals. The former can attract well-insured patients from a distance; many of these can be charged above cost of care; this surplus has traditionally been used, in part, to help subsidize care of uninsured or underinsured patients. Larger teaching hospitals are likelier to have reserves—endowment, access to philanthropy, and depreciation funds—that are usually less available to smaller institutions. Typically, teaching hospitals treat a city's decision makers, facilitating their access to capital for maintenance, reconstruction, or growth.

Since hospitals, to a great degree, serve physicians, it is hypothesized that they will close or relocate if too many of their physicians depart. Because teaching hospitals employ residents and other salaried physicians to admit and care for patients, they are cushioned against many of the consequences of private physician behavior. Nonteaching community hospitals, especially those dependent on older physicians in private practice, may be forced to close or relocate if secular changes in urban physicians' distribution by degree of specialization or location gradually reduce use of the facility. Physicians' practice patterns are influenced both by their own preferences and by their patients' locations.

Demographic change is hypothesized important to the survival of the

hospitals of the cities studied. In 1940, 11.0 percent of the population of these 52 cities was "minority (black or Hispanic)." This rose rapidly and steadily to 42.0 percent in 1980. During this period—a time of rapid evolution in the practice of medicine—large teaching hospitals grew, and demographic change in many cities disrupted patterns of practice by neighborhood-based primary care physicians. The change directly undermined many smaller and mid-size community hospitals by yielding a less well-insured population of potential patients in proximate residence. Indirectly, it spurred some physicians who had used these hospitals to follow patients to their new communities.

A hospital's financial status may reflect many of the forces influencing closure or relocation. Hospitals in poor financial condition are expected to be likelier to close (other things equal) though not all those with financial problems will shut their doors. Similarly, not all those with equally severe financial problems will close at the same time. We expect that responses to financial stress would depend on several factors: the expected depth and duration of the stress, the need and desire of the institution (or of those most influential in it) to remain in its current location, and the opportunities for relocating. Larger teaching hospitals serving many Medicaid or other inadequately insured patients might feel a need to remain at their sites, and would tend to be too large and costly to move. They would be likelier to have the resources to survive operating deficits, at least for a time, while attempting to raise revenues, cut costs, and possibly reduce services to patients unable to pay.

Somewhat smaller hospitals, with limited teaching programs, and serving communities defined by cultural—religious or ethnic—as well as spatial boundaries might be likelier to relocate to follow those communities and their physicians, particularly if former residents and physicians relocated as a group. The religious affiliation or ethnic identification of a hospital might serve as a surrogate measure for the cohesiveness of the original community served, and also for ability to finance a reconstruction.

Smaller hospitals, particularly those lacking a distinct identity in a community, are hypothesized likelier to close when stressed financially. They would be likelier to have relied on the patients hospitalized by a small number of physicians, whose departure could cripple the institution's census of paying patients. Because such a hospital's identity would have been principally spatial, it would lack the incentive to relocate. It would also tend to be less likely to have the resources to do so. Revenues required for the hospital to remain open in place could well be inadequate if the community's new residents are minority group members with disproportionately low incomes and rates of health insurance coverage.

METHODS

A number of cities sufficient to yield a study sample adequate to learn the causes and impacts of voluntary hospital closings and relocations was sought. We also desired a measure of representativeness by region and city size. Therefore, all large central cities of SMSAs with a 1970 population above one million were included, along with 21 of 94 SMSAs of between one-quarter million and one million (see Appendix A).

Central cities were singled out because it was feared that many of their residents were in disproportionate danger of under-service and that their hospitals were vulnerable to stress for the reasons hypothesized above. These cities were also important in their own right. In 1980, they housed about 36.3 million people, or one-sixth of the U.S. total population, along with two-fifths of all blacks and one-third of all Hispanics. Further, they held over ten percent of all short-term hospitals and almost one-quarter of all short-term beds. Their entire metropolitan areas housed 43.8 percent of all Americans in 1980 and 42.4 percent of the nation's nonfederal short-term hospital beds.

The starting date of 1937 was selected for three reasons. First, excellent data on U.S. hospitals are available for that year [7]. Second, large numbers of cities were tracted for the U.S. Census of Population for the first time in 1940. Third, the results of the massive wave of hospital construction which began in this country late in the 19th century and continued throughout the 1920s could be captured in time to permit subsequent analysis of the impacts of the demographic and medical shifts that followed the Second World War.

Hospital behavior during four successive periods (1937–50, 1950–60, 1960–70, and 1970–80) was studied. The characteristics of hospitals open at the beginning of each period, and of their physicians and patients, were used to contrast hospitals which closed, relocated, and remained open, and to predict which hospitals would remain open at their original locations ten years later. Hospital behavior during these four periods was examined to learn whether the extent or reasons for closure/relocation seemed to change over time. This would help evaluate whether the results of the most recent analyses (for 1970–80) would be useful to predict hospital behavior during the decade of the 1980s. Because more comprehensive information about hospitals, physicians, and patients was available for recent periods (and especially for 1970–1980), care was taken to run parallel analyses for all periods, using similar variables, before conducting the more detailed analysis for the final period. All variables used for the different purposes are listed in Appendices B and C; they are specified in Appendix D, where sources are also indicated.

Published directories and guides for 1937, 1946, 1950, 1960, 1970, 1980, and intermediate years were the principal resources in identifying institutions which might have closed or relocated. Initial classification of the hospitals as closed, relocated, or open was made blindly, before institutional characteristics (except for beds) were recorded or assimilated. When the published record was unclear, hospital behavior was investigated through informed persons in the city in question. Hospitals were considered closed if they discontinued inpatient acute care services; in almost all instances, this meant a total cessation of service. Relocations were defined as moves of one-half mile or more. Almost all moves were considerably longer; most meant a departure from the city to its suburbs. A guiding principle in categorizing hospitals was to follow the inpatient beds themselves. Formal mergers were ignored unless they resulted in the closure of all of the beds operated at one of the sites.

Included were short-term acute care nonfederal general and "other special" hospitals which had 50 or more beds at any time during the study period. These were institutions with an average length-of-stay of less than 30 days. Pediatric, obstetric, and eye and ear hospitals were included. Excluded were all psychiatric or chronic disease hospitals.

FINDINGS

A COMPARISON OF HOSPITALS THAT CLOSED, RELOCATED, AND REMAINED OPEN

In each of the four periods studied, hospitals closing or relocating were, on average, significantly smaller than those remaining open (see Table 3). They were also much less likely to offer teaching programs for interns or residents; this is also indicated by their lower ratios of house staff per bed. Beginning around 1960, hospitals closing or relocating experienced lower initial occupancy rates than those remaining open (though occupancies for the two groups remained almost identical in the larger Northeast/Midwest cities). A higher proportion of minorities in the "area" (defined as the census tract in which the hospital was located plus all contiguous tracts whose boundaries were roughly equidistant from the hospital) around hospitals which closed or relocated is notable in all periods and is significant in all but the first. These findings point to a regular pattern of behavior, and one which is consistent with the second outlook on hospital survival.

More complete data are available to compare hospitals closing, relocating, and remaining open during the 1970s (see Table 4). In most respects, these again support our outlook on hospital behavior. Smaller

Table 3: Voluntary Hospitals Closing/Relocating Contrasted to Those Remaining Open, All Cities, 1937–1980

Characteristic[a]	*Period*											
	1937–50			*1950–60*			*1960–70*			*1970–80*		
	C/R	*Open*	*Sig.*[b]	*C/R*	*Open*	*Sig.*[b]	*C/R*	*Open*	*Sig.*[b]	*C/R*	*Open*	*Sig.*[b]
Beds	88.6	195.1	.0001	133.0	199.4	.0006	162.8	271.8	.0001	166.1	329.9	.0001
% Teaching	23.1%	68.4%	.0001	62.8%	79.2%	.0133	54.9%	73.4%	.0051	42.7%	70.8%	.0001
House Staff/ 100 Beds	3.0	4.1	.1152	4.0	6.2	.0050	5.2	6.2	.3507	3.5	6.7	.0003
Occupancy Rate	—	—	—	73.3%	75.8%	.3953	69.3%	78.6%	.0006	73.9%	83.7%	.0001
Area % Minority	19.9%	14.2%	.1985	35.9%	17.4%	.0001	48.1%	24.6%	.0001	46.7%	33.0%	.0011
Number of Hospitals	25	469	—	43	466	—	51	497	—	82	484	—
% of Hospitals	5.1%	94.9%	—	8.5%	91.5%	—	9.3%	90.7%	—	14.5%	85.5%	—

[a]Separate values are given for hospitals closing/relocating or remaining open during each period; values are for the year beginning the period. Most characteristics are expressed as means; others are proportions or means of proportions. Included are the hospitals with 50 or more beds at the beginning of a period in 51 cities (Minneapolis excluded).

[b]Significance of difference between C/R and Open, t-test.

Table 4: Hospitals Closing, Relocating, and Remaining Open, 1970–80

Hospital Characteristic	*Closing/Relocating*[a]				
	Closing	*Relocating*	*Clos/Reloc*	*Remaining Open*	*Significance*[b]
Beds	131.5	233.9	166.1	329.9	.0001
Change in beds, 1970 less 1950	−0.6	+36.5	−0.7	+60.2	.0001
Number of facilities	10.1	15.6	12.2	20.0	.0001
Plant assets/bed	$15,753	$25,656	$19,103	$26,959	.0007
Cost/admission	$ 736	$ 745	$ 743	$ 784	.3246
Religious affiliation	26.8%	51.9%	34.1%	46.6%	.0358
Teaching hospitals	33.9%	59.3%	42.7%	70.8%	.0001
Strength of med. school affil.	.05	.63	.243	.805	.0001
House staff/100 beds	2.9	4.6	3.4	6.7	.0003
Full physicians/100 beds	65	56	63	53	.1530
Courtesy physicians/100 beds	58	82	67	46	.0421
Private patients	73.6%	81.8%	76.1%	74.0%	.5657
Occupancy rate	70.8%	80.8%	73.9%	83.7%	.0001
Change in occup., 1970 less 1960	−3.3%	+4.2%	−1.0%	+4.8%	.0043
Minority inpatients	49.8%	26.7%	41.9%	25.8%	.0006
Medicaid inpatients	27.0%	12.9%	21.7%	14.4%	.0092
Area percent minority	51.2%	39.5%	46.7%	33.0%	.0011
Tract income/city-wide	83.3%	79.9%	82.6%	87.0%	.3152
City-wide beds/1000	6.78	6.58	6.78	6.89	.5999
City-wide occupancy	81.0%	82.0%	81.3%	81.5%	.7717
Beds within 2 miles	2874	1720	2443	1665	.0003
Occ. rate within 2 miles	80.9%	83.3%	81.8%	81.3%	.5490
Net revenues/expenses	95.1%	94.3%	94.8%	96.5%	.2116
Deductions/gross revenues	12.1%	10.8%	11.5%	11.3%	.8615
1980 city size (000)	1215	765	1069	1109	.7051
% Northeast-Midwest	71.4%	55.6%	66.3%	71.0%	.3851
Number of hospitals	56	27	82	487	—

[a]Those closing/relocating will not always be the weighted mean of the two categories; some hospitals were dropped from some tabulations.
[b]Between those remaining open and those closing/relocating combined.

hospitals located in minority neighborhoods, with fewer house staff and greater service to minority and Medicaid patients, were indeed likelier to close during the 1970s. Relocation seems to have been a more discretionary behavior, more closely related to the hospital's affiliation, region, city size, and rate of population growth than closure. Hospitals relocating were likelier than those closing to have had the house staff and the private physicians needed to care for a wide mixture of patients, but their commitments to Medicaid or minority patients were less than would have been expected from the minority population of the neighborhoods in which they were located.

The mean values in Table 4 may well mask wide divergences, particularly for hospitals remaining open; a bi-modal distribution on many characteristics is suspected. As will be suggested later, the group of hospitals surviving the 1970s includes both a number of financially solid institutions (especially those serving well-insured patients), and a number of hospitals, including many large and well-known tertiary institutions, which are financially vulnerable, in part because they serve high proportions of poorly insured patients.

MULTIVARIATE ANALYSES OF HOSPITAL BEHAVIOR

Findings from regression analyses during the four successive study periods are briefly sketched. These are followed by more refined regression and logit analyses of hospital behavior during the 1970s. The validity of selected models is explored.

While multiple regression is not the theoretically preferred method of analyzing a dichotomous dependent variable, it is inexpensive and can be fairly accurate. One disadvantage is that it can yield predicted probabilities of survival greater than 1.0 and below 0.0. This is not a serious practical problem. Three methods have been employed to weigh the accuracy and usefulness of the regression results obtained. One test was made using a split sample. Then, variables found significant in regressions were tested using logits. Finally, the predicted versus actual behavior of hospitals via the two methods was compared.

Parallel analyses of hospital behavior across the four study periods could be made for the large cities only. (Problems of data availability precluded study of the 21 smaller cities, and also of Minneapolis and the New York City boroughs of Manhattan, Queens, and Staten Island. All but Minneapolis are included in the more detailed analysis of hospital behavior during the 1970s which follows shortly.) Each of the analyses now reported employs a similar set of variables—almost identical after 1937—to gauge whether the systematic characteristics for which data are

available change in their usefulness in explaining hospital behavior over time (see Appendix B).

A clear pattern emerges (see Table 5). After controlling for other variables entered into the regression equation and offering other candidates for entry, hospitals in black neighborhoods, less specialized nonteaching hospitals, those with lower occupancy rates or adding fewer beds, were significantly likelier to close or relocate. Area black proportion was the most significant single variable during two of the last three periods; increase in this proportion was the second most important variable during the last period.

The regression R^2 for all significant variables rose steadily from 3.7 percent in 1937–1950, to 11.5 percent in 1950–1960, to 12.2 percent in 1960–1970, and to 21.3 percent in 1970–1980. This indicates that the fairly consistent set of variables employed became increasingly accurate and useful over time in distinguishing the hospitals which closed or relocated from those which remained open. It suggests that hospital behavior became increasingly predictable or explainable by this set of variables. Thus, closures and relocations may have become less discretionary, idiosyncratic, or random in recent years, and more likely to have been associated with the identified set of characteristics.

More detailed multivariate analyses have been made of hospital behavior during the 1970s. These incorporate data on inpatients by race and payment source from the 1973 Office for Civil Rights Hospital Compliance Reports, and on finances from the American Hospital Association's 1970 Annual Survey. Findings from three regressions and associated logits are reported here. In each instance, the candidates for entry into the regression were the variables listed in Appendix C; the logits tested variables that were significant in the associated regression, with the addition of a few others hypothesized to be important. The three sets of analyses concern (1) closures and relocations versus ongoing hospitals in all 51 cities (Minneapolis had to be excluded); (2) the same in the Northeast and Midwest cities only; and (3) closures alone versus ongoing hospitals in the 51 cities.

Variables which distinguished hospitals closing or relocating from those remaining open in all cities are reported in Table 6. Seven variables were significant in both regression and logit analyses; two additional variables appeared, one in each analysis. The regression equation R^2 was 22.39 percent. A hospital with more house staff per bed was likelier to remain open; this variable was most powerful in predicting hospital behavior. Hospitals with fewer courtesy physicians per bed were likelier to remain open, as were hospitals whose net revenues less expenditures (as a share of net revenues) were greater. Hospitals with more full attending

Table 5: Regression Results: Characteristics Predicting Closure/Relocation Versus Continued Operation, Three Periods, 1950–1980, 30 Larger Cities

Characteristic	*1950–1960*		*1960–1970*		*1970–1980*	
	Coefficient	*Significance*	*Coefficient*	*Significance*	*Coefficient*	*Significance*
Intercept	.8973	—	.7990	—	−.0769	—
Area percent black, I	−.0027	.0003	−.0033	.0001		
Relative median income, I.	−.7380	.0063				
Number of special services, I.	.0123	.0136				
Area population, change, P.D.	−.0062	.0370				
Change in beds, P.T.D.			.0004	.0148	.0007	.0191
Change in area % black, P.D.			.0030	.0265	−.0029	.0004
Teaching status, I.			.0879	.0566	.1376	.0054
Occupancy rate, I.					.0087	.0001
n	271		279		264	
R^2	11.46%		12.21%		21.30%	
Significance	.0004		.0001		.0001	

I = initial, as of beginning of decade studied
PD = during prior decade
PTD = during prior two decades

Table 6: Closures and Relocations: Significant Regression and Logit Variables, All Cities, 1970–1980

Hospital Characteristics	*Regression*		*Logit*	
	Coefficient[a]	*Significance*	*Sign*[b]	*Significance*
Intercept	1.1359	—	—	—
House staff/bed	1.0524	.0001		.0250
Courtesy staff/bed	−.1234	.0003	−	.0500
(Net revenue-expenditures)/ net revenue	.5053	.0003	—	—
Full staff/bed	−.1334	.0083	−	.0500
Beds within one mile (000's)	−.0475	.0109	−	.0050
Occupancy (1970 less 1960)	.3897	.0120		.0100
Inpatient % minority	−.1774	.0126	−	.0100
Beds	.000077	.3505		.0050

$R^2 = 22.39\%$; significant at .0001.

n = 304

[a]A positive coefficient signals a positive relation of this variable to probability of remaining open.

[b]Only negative logit signs are noted.

physicians per bed were also more likely to close or relocate; so too were hospitals with more beds within one mile. Hospitals with higher occupancy rates were more likely to remain open. Those with greater minority inpatient shares were more likely to close or relocate. Each of the significant variables helped to predict hospital behavior, even after controlling for all of the other variables in the regression equation [8].

The logit's results were very similar. All variables' signs were identical, meaning that if a greater value for a variable was associated with a higher probability of remaining open in the regression, the same was true in the logit. Of all the significant regression variables, only the financial measure was not significant in the logit. A hospital's number of beds, not a significant variable in the regression, proved to be strongly significant in the logit. Overall, the relative significance of variables differed somewhat between the logit and the regression. The logit's accuracy in distinguishing hospitals which closed/relocated from those which remained open was slightly greater (88.9 percent correct) than that of the regression (83.5 percent). It should be noted, however, that the logit does distinguish the two groups of hospitals more sharply (see Table 9) [9].

In the regression and the logit on hospitals in all Northeastern and Midwestern cities that were closing or relocating versus ongoing, 236 hospitals could be studied. An R^2 of 32.42 percent was achieved by the regression; 11 independent variables were significant (see Table 7). Variables new to this analysis include the hospital's share of privately

Table 7: Closures and Relocations: Significant Regression and Logit Variables, All Northeast/Midwest Cities, 1970–1980

	Regression		*Logit*	
Hospital Characteristics	*Coefficient*[a]	*Significance*	*Sign*[c]	*Significance*
Intercept	2.4180	—	—	—
(Net revenue-expenditures)/ net revenue	.6985	.0004		.1000
Inpatient % minority[b]	−.2435	.0010	−	.0100
Full staff/bed	−.1636	.0012	−	.0050
% Private admissions	−.3278	.0017	−	—
Occupancy (1970 less 1960)	.4591	.0036		.0050
Strength of medical school affiliation	.0446	.0037		.0050
Gross revenue/expenditures	−.3527	.0059	−	—
City-wide occupancy	−1.0940	.0179	−	.0050
Construction in progress	.0709	.0317		.0500
City-wide % minority (1980 less 1960)	.3670	.0342		.0500
Beds (1970 less 1950)	.0003	.0408		.0050

$R^2 = 32.42\%$; significant at .0001.
n = 236

[a]A positive coefficient signals a positive relation of this variable to probability of remaining open.

[b]Correlates with inpatient % Medicaid at .6623.

[c]Only negative logit signs are noted.

admitted patients. This has a fairly strong negative correlation with the hospital's house staff per bed ($r_p = -.309$; significant at .0001), and denotes hospitals more dependent on private physicians than on house staff working in outpatient departments or emergency rooms. After controlling for proportion of minority inpatients and the other variables entered into the regression, hospitals located in cities with greater increases in city-wide minority population share between 1960 and 1980 were likelier to remain open. Since this is controlled for the hospital's own inpatient minority proportion, this relation may reflect greater likelihood that the surviving hospitals received nonminority patients from the changed neighborhoods. Hospitals located in cities with greater city-wide occupancy rates were likelier to close. Just the opposite had been expected. No greater competitive pressure seems to have been exerted in these cities—that would have followed (other things equal) from lower city-wide occupancy rates, which might have led hospitals to compete more vigorously for paying patients from endangered institutions.

All but three of the variables significant at 0.05 or better in the regression were also found to be significant in the logit. The exceptions

were the two financial variables of net revenues less expenditures as a proportion of net revenues and gross revenues/expenditures, and the hospital's percentage of private admissions. Each variable's sign was again the same in regression and logit. Once again, the logit's predictive accuracy (90.8 percent correct) proved slightly superior to that of the regression (87.0 percent).

A regression and a logit were run on only those hospitals open in 1970 which either closed or remained open during the following decade (see Table 8). Relocations were excluded. It is instructive to compare the results of these analyses with those on closings and relocations together, in the same cities (see Table 6). All seven of the variables which were significant in predicting closure and relocation were also significant in the regression predicting closure alone. Their comparative importance, however, was considerably different. This is not surprising, since the excluded hospitals relocating more closely resembled those remaining open in many ways. Also, a hospital's outpatient visits/bed [10] and whether or not it had construction in progress in 1970 were useful only in predicting closures.

While physician and financial variables were most prominent in predicting either closure or relocation, the two most important variables in predicting closure alone were the hospital's inpatient minority proportion and the number of other acute care beds located within one mile.

As a group, hospitals with greater numbers of other beds located within one mile tended to be more expensive ($r_p = .232$; significant at .0001), to have more house staff per bed ($r_p = .160$; significant at .0061), and to serve greater shares of Medicaid-funded patients ($r_p = .154$; significant at .0084). The hospitals closing, however, have been less expensive, and have had fewer house staff per bed, more courtesy physicians per bed, a greater share of Medicaid-funded inpatients, and of course, more beds located at other hospitals within one mile. This pattern suggests that the hospitals with more acute care beds within one mile tend to be a heterogeneous group. The somewhat more expensive hospitals with more house staff per bed were more likely to remain open despite their commitment to Medicaid-funded patients and the proximity of so many other beds, while those relying more heavily on private physicians and Medicaid-funded patients were obliged to close in greater numbers. Larger teaching hospitals have probably been able to remain open even in older and more crowded neighborhoods for several reasons: (1) the ability to attract an adequate number of well-insured patients; (2) by securing physicians to admit those patients; (3) access to capital markets; and (4) reserves of endowment and depreciation income. What must be decided is whether these strengths justify or legitimize the resulting distribution of urban hospital care. The impacts of the closing of smaller

Table 8: Hospital Closures: Significant Regression and Logit Variables, All Cities, 1970–1980

	Regression		*Logit*	
Hospital Characteristics	*Coefficient*	*Significance*	*Sign*[a]	*Significance*
Intercept	.7068	—	—	—
Inpatient % minority	−.1874	.0007	−	.0050
Beds within one mile (000's)	−.0498	.0012	−	.0005
Full staff/bed	−.1001	.0137	−	.0050
Courtesy staff/bed	−.0684	.0140	−	.1200
(Net revenues-expenditures)/ net revenues	.3729	.0277		—
Occupancy	.3556	.0352		.0050
Outpatient visits/bed (000's)	.2795	.0362		.1000
Construction in progress	.0564	.0377		.0250
House staff/bed	.4753	.0627		.1000

$R^2 = 25.27\%$
n = 291
Significant at .0001.
[a]Only negative logit signs are noted.

nonteaching hospitals which lack affordable nearby substitutes must be explored as well.

To evaluate the validity of the regression and logit results, a split sample test of one early regression's accuracy was made. To secure a large sample, variables were excluded if they were known frequently to be missing. In all, 441 hospitals in 51 cities could be included; a model relying on 70 percent (311) yielded an R^2 of 15.5 percent. Setting the predicted value of remaining open at 0.85 or greater, the regression equation correctly categorized 68.8 percent of the original 311 institutions. The same equation correctly categorized 72.3 percent of the remaining 30 percent of the hospitals.

The greatest share of correct hits was achieved by the logit on hospitals closing versus those ongoing (see Table 8). Fully 94.9 percent of all hospitals were correctly categorized here (see Table 9), with the predicted value of remaining open set at 0.80 or greater. The R^2 for the regression closely resembling this logit was 25.27 percent. Together, these two analyses—along with the logit results—support the decision to employ regression on the study's dichotomous dependent variables.

DISCUSSION

Our theory of urban voluntary hospital closings and relocations seems generally to have been confirmed. Hospital, physician, and patient

Table 9: Predicted versus Actual Hospital Behavior: All Cities, 1970–1980, Close versus Open, Regression and Logit

	Actual Behavior							
	Regression (R^2 = 25.27%)				*Logit*			
Predicted Probability	*Close*		*Remain Open*		*Close*		*Remain Open*	
of Remaining Open	*n*	*cum %*[a]	*n*	*cum %*[a]	*n*	*cum %*[a]	*n*	*cum %*[a]
≤.39	0		0		12	50.0%	4	1.2%
.40–.49	0		0		2	58.3	2	1.8
.50–.59	4	21.1%	0		0		2	2.5
.60–.69	5	47.4	9	3.2%	3	70.8	0	
.70–.79	7	84.2	22	11.2	2	79.2	5	4.0
.80–.89	2	94.7	54	30.6	4	95.8	20	10.1
.90–.99	1	100.0	95	64.8	1	100.0	294	100.0
≥1.00			98	100.0				
correct hits/total:	16/19		247/278		19/24		314/327	
% correct								
column	84.2%		88.8%		79.2%		96.0%	
analysis		88.6%				94.9%		

[a] cum. % = cumulative percentage of hospitals in this column with this or lower predicted probability of remaining open

characteristics have been independently and significantly associated with hospitals' probabilities of remaining open in the ways hypothesized. Two remaining questions are whether the impacts of observed patterns of hospital closings and relocations have been desirable and whether these patterns can be expected to continue.

The major consequences of hospital behavior seem to have been to move urban health care toward a potentially more effective but less accessible and more costly system. Average effectiveness of hospital care potentially available to central city residents has probably risen owing to the closing of some smaller, less well-equipped hospitals—some of whose physicians may have been less competent than average. But this potential benefit may not have been realized for many of the patients displaced by a closing. First, they may not have sought care at a surviving hospital owing to increased travel time or other factors (or they may not have sought care soon enough); second, they may have been denied admission at a surviving hospital; third, patients suffering from routine problems, which probably tend to be of lesser interest to physicians and other workers in surviving tertiary hospitals, may not have received care of the competence potentially available in these institutions. Further, the improvements in effectiveness may not be commensurate with patients' needs; an over-concentration of beds in costly tertiary facilities may result.

Although closings of smaller hospitals have worked in politically expedient ways to offset partly the overbedding resulting from overbuilding by larger voluntary institutions, the observed pattern of closings also seems to have reduced spatial access to urban health care. While one hospital's closing may not badly compromise access, the loss of two or three or four of the hospitals serving high proportions of minority and Medicaid-funded patients can have a dangerous cumulative impact in a city. Large areas of several cities have lost most or all of their hospitals. These include northern St. Louis, southern Atlanta, and western Philadelphia. Hospitals have been lost as providers of organized outpatient and emergency services, and as anchors with institutional interests in stabilizing or supporting neighborhood health centers and physicians in private practice.

Problems of reduced spatial access to care seem to have been compounded by reduced financial access. As less costly hospitals close, their displaced patients are forced to seek care increasingly at expensive teaching hospitals. Medicaid-funded patients, disproportionately served at closed hospitals, are strongly affected. The average cost per admission (not case-mix-adjusted) at hospitals remaining open within one mile of those which closed from 1970 to 1980 was 44.0 percent greater than that of the closing hospitals which closed (see Table 10). Closing of the less

Table 10: Voluntary Hospitals Closing 1970–1980 Compared With Those Located Within One Mile Which Remained Open

Characteristics	*Hospitals Closing 1970–1980*[a]	*Hospitals Remaining Open Within One Mile*	*All Hospitals*
Beds, 1970	148.0	453.1	329.9
Occupancy, 1970	73.6%	80.0%	83.7%
Length-of-stay, 1970	10.6	11.5	9.40[b]
Cost per admission, 1970	$638	$919	$784
Teaching hospital, 1970	43.2%	80.5%	70.8%
House staff/100 beds, 1969	6.0	11.2	6.7
Outpatient visits/bed, 1970	103.7	269.0	182.0
Admitted by private M.D., 1973	74.4%	58.3%	74.0%
Full physicians/100 beds, 1973	63.2	50.3	53
Courtesy physicians/ 100 beds, 1973	53.3	35.4	46
Private health insurance inpatients, 1973	34.5%	38.4%	51.0%[b]
Medicare inpatients, 1973	21.5%	29.9%	22.4%
Medicaid inpatients, 1973	29.1%	27.2%	14.4%
Minority inpatients, 1973	49.0%	35.4%	25.8%
Area percent minority, 1970	48.9%	45.4%	33.0%
Deductions from revenues/ gross revenues, 1970	15.0%	14.4%	11.3%
Deductions from revenues/bed, 1970	$4,042	$5,332	$3,802
Net revenues/expenses, 1970	95.2%	89.1%	96.5%
n	30	$\bar{x}$30 groups	487

[a]Those with at least one hospital remaining open within one mile
[b]Estimate

expensive hospitals may have increased Medicaid costs, and thereby contributed to reductions in Medicaid reimbursement rates, eligibility, or benefit levels—harming both recipients and the providers that sought to serve them.

Hospital closings have reinforced patterns of care under which this nation's poorest urban citizens are served in the world's costliest hospitals, or are not served at all. Because cost of care is difficult to control once access is won, it is to be feared that efforts to slow increases in spending will rely principally on limiting the number of patients effectively eligible for care. In a sense, the best becomes an enemy of the good. The high costs of hospitals serving the poor may have become an excuse for disenfranchising many such patients. One new mechanism which may work to accomplish this would be proposals to advance "competition" which underpay the costly hospitals that continue to serve Medicaid and

minority patients in disproportionate numbers. Hospitals which do not serve the poor or provide tertiary care or train physicians may be at an advantage in the future as competition among surviving urban hospitals and physicians for a shrinking pool of well-insured patients grows in intensity.

Some evidence suggests that minority and Medicaid patients' use of hospital care in the 52 cities studied had begun to decline even before the passage of recent federal budget cuts. Between 1970–73 and 1980–81, minority hospital census per 1000 minority residents in the 52 cities fell from 3.74 to 3.47 (7.2 percent). Medicaid census/1000 total residents declined from 0.76 to 0.70 (7.9 percent), and the proportion of total census financed principally under Medicaid fell by 13.5 percent. While these rates are not age-adjusted, they are worth noting as one possible overall indication of the impacts of the documented pattern of hospital closings and other changes in urban health care financing and delivery.

This apparent decline in minority and low-income citizens' access to care is particularly frustrating, given the ongoing increase in the share of gross national product devoted to hospital care. This proportion rose from 0.6 percent in 1929, to 2.7 percent in 1970, and to 3.9 percent in 1981. For much of this time, higher spending on hospital care was probably associated with enhanced equality of access; today, even cuts in access seem to do little to slow spending increases.

Although larger teaching hospitals and hospitals located in non-minority areas have been more likely to remain open in past decades, there is little reason for confidence that the closure of weaker institutions will strengthen those which have survived, or that a socially desirable steady state will be achieved soon. Many of the larger teaching hospitals that remain open today are in considerable financial difficulty. Patients displaced by the closing of a hospital seek coverage at nearby facilities. The declining capacity of urban public general hospitals means that many patients displaced by voluntary hospital closing/relocation will appear at the doors of remaining voluntary institutions. These hospitals are likely to be harmed financially if they admit large numbers of additional Medicaid patients (who are reimbursed below costs in many states) or patients unable to pay. The alternative will be harm to the health of the patients denied service.

Even in 1970, the finances of many of the larger teaching hospitals that survived until 1980 were precarious. Hospitals remaining open within one mile of those that closed suffered net revenues in 1970 equal to only 89.1 percent of expenditures, considerably below the average ratio for all hospitals remaining open—or even for those that closed (see Table 10). Hospitals outside minority areas have tended to remain more secure financially. Smaller or nonteaching hospitals or those located in minority

neighborhoods have been likelier to close. While many of the larger teaching institutions which have survived in central cities faced financial problems at the beginning of the 1970s, they are probably in worse condition today—particularly if they have been accepting patients displaced by the closing of smaller voluntaries. Indeed, one reason for the growing visibility of the issue of urban voluntary hospital closing has been the financial distress suffered by larger and better-known teaching institutions.

Surviving small and mid-size hospitals resembling those which closed in past decades will probably experience great difficulties in remaining open in coming years. They will be joined by many of the increasingly endangered larger voluntary teaching hospitals. The strengths of central cities' large teaching hospitals—their special services, house staff, and attractiveness to many well-insured patients—helped them survive the 1970s while serving large numbers of Medicaid-funded and minority patients. Their continued ability to function in this way, even without assuming responsibility for the care of patients displaced by closure, is doubtful. The choice these hospitals face—that our society faces—is to restructure care to make it more equally affordable, or to deny growing shares of our population access to the potentially effective but costly care which remains available in large teaching hospitals.

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10. Kennedy L. Personal communication.

Appendix A: Study Cities

I. *Larger Cities*: *Central cities of SMSAs of 1,000,000 or more in 1970*

A. *Northeast and Midwest*
(*HHS Regions I, II, III, V, and VII*)

- Baltimore
- Boston
- Buffalo
- Chicago
- Cincinnati
- Cleveland
- Columbus, Ohio
- Detroit
- Indianapolis
- Kansas City, Mo.
- Milwaukee
- Minneapolis*
- New York**
- Newark
- Philadelphia
- Pittsburgh
- St. Louis
- Washington DC

B. *South and West*
(*HHS Regions IV, VI, VIII, IX, and X*)

- Atlanta
- Dallas
- Denver
- Houston
- Los Angeles
- Miami
- New Orleans
- Portland, Ore.
- San Diego
- San Francisco
- San Jose
- Seattle
- Tampa

II. *Smaller Cities*: Central cities of SMSAs of 250,000–1,000,000 in 1970

A. *Northeast and Midwest*

- Bridgeport, Conn.
- Fort Wayne, Ind.
- Gary, Ind.
- Hartford, Conn.
- Jersey City, N.J.
- Paterson, N.J.
- Peoria, Ill.
- Toledo, Ohio
- Trenton, N.J.
- Wilmington, Del.

B. *South and West*

- Austin, Tex.
- Beaumont, Tex.
- Charlotte, N.C.
- Columbia, S.C.
- Louisville, Ky.
- Memphis, Tenn.
- Norfolk, Va.
- Phoenix, Ariz.
- San Antonio, Tex.
- Tucson, Ariz.
- Wichita, Kan.

*Included in discussions of reconfigurations and closings, 1937–80; excluded from subsequent descriptions and multivariate analyses.

**Five boroughs treated individually.

Appendix B: Regression Independent Variables Each Period

1. Teaching program, 1937, 50, 60, 70
2. Beds, 1937, 50, 60, 70
3. Years-at-site, 1937, 50, 60, 70
4. Restrict admission of blacks, 1937
5. Religious ownership-affiliation, 1937, 50, 60, 70
6. Number of special services (facilities), 1950, 60, 70
7. Occupancy rate, 1950, 60, 70
8. Average cost/admission, 1950, 60, 70
9. Average cost/patient-day, 1950, 60, 70
10. Personnel/census, 1950, 60, 70
11. Tract percent black, 1940, 50, 60, 70
12. Area percent black, 1940, 50, 60, 70
13. Tract median income, 1950, 60, 70
14. Tract income relative to city-wide income, 1950, 60, 70
15. City-wide bed/population ratio, 1937/40, 50, 60, 70
16. City-wide occupancy rate, 1950, 60, 70
17. City-wide percent black, 1940, 50, 60, 70
18. Change in beds, prior decade
19. Change in area percent black, prior decade
20. Change in area population, prior decade
21. Change in beds, prior two decades
22. Change in area percent black, prior two decades
23. Change in area population, prior two decades
24. Change in beds, since 1937
25. Change in area percent black, since 1940
26. Change in area population, since 1940

Appendix C: Regression Independent Variables: 1970–1980 Analyses

House staff per bed
Medical school affiliation
Teaching status
Number of facilities
Degree of specialization
Occupancy rate
Occupancy change, 1970 less 1960
Number of beds
Change in beds, 1970 less 1950
Years-at-site
Area percent black
Area percent minority
Tract percent elderly
Tract's income relative to city's
Tract's income relative to SMSA's
Area population change, 1970 less 1960
Cost per admission
Cost per patient-day
Personnel per census
Religious affiliation
Admit blacks in 1937
City-wide beds/population
City-wide occupancy rate
City-wide percent minority
SMSA beds/population
SMSA occupancy rate
City-wide population 1970/1900
Privately admitted patients
Inpatient percent minority
Medicare patients
Medicaid patients
"No charge" patients
Attendings/bed
Courtesy staff/bed
Beds within one mile
Plant assets/bed
Deductions from revenues/bed
Net revenues/expenses
Gross revenues/expenses
(Net revenues − expenses) ÷ net revenues
Depreciation/bed
Cash flow
Cash flow/bed
Construction in progress
Change in city pop., 1980/1960
Change in SMSA pop., 1980/1960
Change in city-wide % minority, 1980 less 1960
City population, 1980
SMSA population, 1980
Outpatient visits/bed
Location in Northeast or Midwest

Appendix D: Specification of Independent Variables

Group/sub-group	*Variable*	*Specification*	*Source*[1]
HOSPITAL			
size	1. number of beds		PRC, AHA
	2. total assets		AHA*
	3. total assets/bed		AHA*
physical condition	4. years-at-site		PRC, AHA
	5. changes in beds	current number of beds less those of 10, 20, 30 years previous	PRC, AHA
	6. depreciation/bed	deductions from assets ÷ beds	AHA*
	7. construction recently completed	1 = yes 2 = no	AHA*
	8. construction in progress	1 = yes 2 = no	AHA*
	9. construction planned	1 = yes 2 = no	AHA*
	10. construction in progress	if 7, 8, or 9 = 1, = 1 if 7, 8, and 9 = 0, = 0	AHA*
degree of specialization	11. teaching status	1 = teaching hospital 0 = non-teaching	PRC, AHA
	12. number of facilities	number of identified special facilities	AHA
	13. cost/admission		AHA
	14. cost/patient-day		AHA
	15. personnel/census		AHA
	16. degree of specialization	factor of four special services: inpatient dialysis, x-ray therapy, open heart surgery, ICU/CCU	AHA, 1970 only
outlook	17. religious affiliation	1 = present 0 = absent	PRC, AHA
	18. admit blacks in 1937	1 = no barriers or not yet open 0 = restriction or prohibition	PRC
financial condition	19. inpatient % minority	(Blacks & Hispanics) ÷ total	OCR
	20. privately admitted patients	private admissions ÷ total	OCR
	21. transferred patients	transferred ÷ total	OCR
	22. "no-charge" patients	"no charge" ÷ total	OCR
	23. Medicaid patients	Medicaid ÷ total	OCR
	24. Medicare patients	Medicare ÷ total	OCR
	25. occupancy rate	census ÷ beds	AHA

continued

Appendix D: continued

Group/sub-group	*Variable*	*Specification*	*Source*[1]
	26. outpatient burden	total OP visits ÷ inpatient days	AHA*
	27. net revenue/expenses	net revenue ÷ total expenses	AHA*
	28. cash flow	(net revenue) less (expenses less depreciation)	AHA*
	29. cash flow/bed	28 ÷ beds	AHA*
	30. deductions from revenues/bed		AHA*
	31. (net revenues-expenses)/net revenues		AHA*
PHYSICIANS	32. house staff/bed	(interns & residents) ÷ beds	PRC, AMA
	33. attendings/beds	full admitting M.D.s ÷ beds	OCR
	34. courtesy staff/bed	courtesy M.D.s ÷ beds	OCR
	35. all M.D.s/beds	(house staff & attendings & courtesy) ÷ beds	OCR
	36. medical school affiliation	0 = none 1 = minor 2 = major	AMA
	37. physicians per capita	city-wide or county-wide number of physicians ÷ population	ARF
DEMOGRAPHIC ENVIRONMENT	38. tract % minority	(Blacks & Hispanics) ÷ total population of census tract containing hospital	CEN
	39. area % minority	as 38, but for tract containing hospital plus all contiguous tracts whose outer boundaries are roughly equidistant from the hospital	CEN
	40. tract relative income	tract median family income ÷ city-wide median	CEN
	41. area % minority change	area % minority, less that of 10, 20, 30 years previous	CEN
	42. area population change	total population of area, less that of 10, 20, 30 years previous	CEN
	43. tract % elderly	over-65 population ÷ total	CEN

Appendix D: continued

Group/sub-group	*Variable*	*Specification*	*Source*[1]
CITY-WIDE HOSPITAL ENVIRONMENT	44. city-wide beds/ population		AHA, CEN
	45. city-wide occupancy rate	weighted mean	AHA
	46. city-wide percent minority		CEN
	47. age of city	current population as proportion of that in 1900, and 1940	CEN
	48. distance to nearest public general hospital	tenths of miles	map
	49. distance to nearest voluntary hospital of 250 or more beds	tenths of miles	map
	50. hospitals within one, two miles	count	map
	51. beds within one, two miles	count	map
	52. suburban occupancy rate	weighted mean	AHA, CEN
	53. suburban occupancy rate	weighted mean	AHA, CEN
	54. metropolitan area occupancy rate	weighted mean	AHA, CEN

[1]*Sources*

PRC Physicians Record Company, *Guide to American and Canadian Hospitals*, Chicago: The Company, 1937.

AHA American Hospital Association, *Guide Issue*, and *Guide to the Health Care Field*, Chicago: The Association, 1950, 1960, 1970.

AHA* American Hospital Association, Annual Hospital Survey, 1969, Tape.

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local locally published data and informed local, regional, state, and national experts.

map measured from locations mapped by study staff.

ARF Area Resource File.