

Geographic classification of hospitals: Alternative labor market areas

by Nancy De Lew

Medicare hospital payments are adjusted to reflect variation in hospital wages across geographic areas by grouping hospitals into labor market areas. By only recognizing the average wage in an area, Medicare encourages hospitals to contain costs. Labor market area definitions have recently received renewed attention because of their impact on hospital payments.

Alternative labor market areas were evaluated using several criteria, including ability to explain wage variation and impact on payment equity. Rural labor market areas can be improved using county population size; however, further research on urban labor market areas is needed.

Introduction

The Medicare prospective payment system (PPS) provides hospitals with an average payment for each discharge adjusted for factors considered beyond the control of an individual hospital, including the patient's diagnosis, geographic location, wages, teaching, and service to low-income patients. The goal of the wage adjustment, which reflects the relative level of hospital wages across geographic areas, is to reflect differences in labor costs. Hospitals are grouped into geographically distinct labor market areas to minimize the likelihood that an individual hospital could raise its wages, relative to other hospitals, and hence its payments. By reflecting the average hospital wage in a given geographic area, PPS provides hospitals with an incentive to control their labor costs.

The wage index has been criticized for inadequately measuring wages (by excluding contract labor), for overcompensating richly staffed hospitals (by not controlling for occupational mix), and for drawing labor market area boundaries in a seemingly arbitrary fashion (by using metropolitan statistical area [MSA] definitions to define market areas) (Williams, Pettengill, and Lisk, 1990; Prospective Payment Assessment Commission, 1990; 1991). This article evaluates potential refinements to labor market areas. The goal of the analysis is to increase the explanatory power of the wage index as well as improve payment equity in a single-rate system.

The cost-containment goal of grouping hospitals into labor market areas is clear; however, there is no concomitant clarity about what constitutes an appropriately drawn hospital labor market. Originally, MSAs were used to define urban labor market areas. Counties not included in an MSA were grouped into statewide rural labor market areas. MSAs have been criticized as hospital labor market areas because hospitals that appear otherwise similar, but are located on either side of a county boundary, may receive

significantly different payments under PPS (Prospective Payment Assessment Commission, 1989). Occasionally there are wide variations in the wage-index values between two adjacent labor market areas. For example, the adjacent MSAs of Allentown-Bethlehem-Easton, Pennsylvania, and Philadelphia, Pennsylvania, have a 17-percent difference in their fiscal year (FY) 1992 wage index values.

Rural and urban hospitals that border areas with a higher wage index complained of unfair treatment. Subsequently, Congress established several provisions whereby hospitals may change their location for payment purposes. The most notable example is the Medicare Geographic Classification Review Board established by the Omnibus Budget Reconciliation Act of 1989 (Public Law 101-239), which reclassified nearly 1,000 hospitals in FY 1992 and FY 1993 from one labor market area to another, thereby providing new impetus for the refinement of labor market areas. (The effects of the Board's decisions are not reflected in the data analysis discussed in this article.)

However, finding other tools to define labor market areas that better reflect hospital wage variation, minimize payment cliffs, and improve payment equity has proved difficult (Wright and Marlor, 1990). Several alternative labor market areas have been examined by researchers hoping to improve upon the original labor market areas. These alternative labor market area definitions largely relied on existing geographic units such as cities and counties.

Rural labor market areas

Hospitals in rural counties adjacent to MSAs claimed that they paid higher wages than did hospitals in non-adjacent rural counties. Hendricks found that adjacent hospitals paid slightly higher wages (4 percent) than did hospitals in non-adjacent counties, but that the difference was not statistically significant (Hendricks, 1989a; U.S. Department of Health and Human Services, 1987). Hendricks found that occupational mix, case mix, teaching activity, and location in a high-rent county were more important than adjacent status in explaining wage variation.

The Prospective Payment Assessment Commission (ProPAC) examined several alternative rural labor market areas including adjacent and non-adjacent counties, urbanized (with a city of 25,000 or more) and

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non-urbanized counties, and rural portions of Bureau of Economic Analysis areas. ProPAC found that urbanized counties were best at differentiating high- and low-wage hospitals and recommended that rural labor market areas be disaggregated based on urbanized and non-urbanized counties (Prospective Payment Assessment Commission, 1987; Schmitz and Merrell, 1987).

Urban labor market areas

Studies of urban wages have found evidence that many types of wages are higher in the center of the metropolitan area than in the surrounding suburban ring (Madden, 1985; Eberts, 1981). Advocates for central city, also called "core," hospitals argued that they paid higher wages than their suburban counterparts, also called "ring," and should receive additional payments through a core city wage index (Ashby, 1984; Ashby and Parmer, 1985). Several studies subsequently examined wage variation in MSAs, using several different measures of core and ring to test the hypothesis that central city hospitals pay significantly higher wages than their suburban counterparts (U.S. Department of Health and Human Services, 1987; Prospective Payment Assessment Commission, 1987; Hendricks and Keller, 1987).

Central counties were found to be superior to urbanized areas or central cities in terms of differentiating high- and low-wage hospitals. (As defined by the U.S. Bureau of the Census: Central county contains the major city, urbanized area has a population density of at least 1,000 people per square mile, and central city is the major city.) ProPAC rejected central counties in favor of urbanized areas because almost one-half of the MSAs are composed of only one county (including such populous areas as Los Angeles and Miami). Surprisingly, the difference between core and ring hospital wages is larger in small MSAs (with a population of less than 250,000) and medium MSAs (with a population from 250,000 to 1 million) than in larger MSAs (Prospective Payment Assessment Commission, 1987; Hendricks and Keller, 1987). The cause of greater wage variation in smaller MSAs is not well understood (Hendricks, 1989b). It has been hypothesized that the difference may be a result in part of the outlying hospitals paying wages that are closer to those of rural hospitals than their urban neighbors pay.

This article evaluates four of the most promising rural and four of the most promising urban labor market areas. The rural alternatives subdivide rural counties in a State based on either population or proximity to an urban area. The urban alternatives subdivide urban areas in an MSA based on proximity to the core of the MSA. The alternative labor market areas were evaluated against the existing areas using four criteria: (1) ability to explain wage variation, (2) uniformity of labor market area, (3) nationwide applicability, and (4) impact on payment equity in a single-rate system. The analysis found that one of the rural labor market areas (based on county population

size) is preferable to the current system based on the evaluation criteria, but that further research is needed before adopting any of the urban labor market areas.

Methodology and data

Under PPS, the labor-related portion of the standardized payment amount (approximately 71 percent of the average standardized amounts) is adjusted for differences in the relative level of wages and fringe benefits across geographic areas. The area wage index is based on several calculations: The labor market area average hourly wage is determined by summing total hospital wages and dividing by total hours, and the area wage index value is determined by dividing the area average hourly wage by the national average hourly wage. In FY 1992, the wage index ranges from a low of 0.6963 in rural Mississippi to a high of 1.4661 in San Jose, California.

Despite criticism, the current labor market areas perform relatively well in explaining wage variation: 68 percent of the variation in urban hospital wages is explained by MSA labor market areas, and 42 percent of the variation in rural hospital wages is explained by statewide labor market areas. (Analysis of variance is used to explain wage variation.)

This article used data from the Health Care Financing Administration (HCFA) 1988 hospital wage survey; the data have been used for payment purposes since FY 1991. The 1988 survey collected total hospital salaries and hours (excluding those associated with skilled nursing facility or other non-hospital cost centers); home office salaries and hours; and fringe benefits associated with hospital and home office salaries from all prospective payment hospitals (approximately 5,500 hospitals). The exclusion of non-hospital costs and the inclusion of fringe benefits and home office costs represent changes from the 1984 HCFA wage survey. Previous research generally used data from the 1982 or 1984 HCFA wage surveys. The wages that hospitals paid in 1988 varied significantly. The average hourly wage was \$13.91, and the range was from \$4.50 per hour to \$25.06 per hour. Further discussion of the 1988 HCFA wage survey may be found in the September 4, 1990, PPS regulation (*Federal Register*, 1990).

Because the current wage index is based on the average hourly wage in the labor market area, some hospitals receive a relatively greater adjustment than their own wages would otherwise warrant, and other hospitals receive a lower adjustment. The average hospital pays wages almost 6 percent below the area average. The bottom 25 percent of hospitals are more than 13 percent below the area average, and the top 25 percent of hospitals are more than 3 percent above the area average. Because the wage index is hour-weighted rather than hospital-weighted, large hospitals (which are more likely to pay higher wages and have more staff hours) have a greater influence on the average area wage than do small hospitals (which are more likely to pay lower wages and have less staff hours).

Evaluation criteria

Each labor market area was measured against four criteria designed to determine which, if any, of the alternatives were superior to the current labor market areas.

Criterion 1: Is the explanation of wage variation improved?—Compared with the current labor market areas, alternative labor market areas should significantly increase the amount of wage variation explained. The methodology used to evaluate explanation of wage variation was analysis of variance; the alternative labor market areas were independent variables and hospital average hourly wage was the dependent variable. The increase in explanatory power (measured by the R^2 statistic) of each alternative labor market area was then compared with the current labor market area.

Criterion 2: Are the new labor market areas reasonable based on hospital wages?—Labor market areas can be defined using a number of different criteria. However sensible these criteria may be in terms of subdividing MSAs or States, they must also be reasonable based on hospital wages. That is, the new labor market areas should seek to improve upon the uniformity of the labor markets from which hospitals draw their workers. The boundaries should minimize the perception of inequitable treatment, whereupon hospitals facing different labor costs are grouped in the same labor market area or hospitals facing similar labor costs are grouped into different labor market areas.

Direct evaluation of boundary problems was beyond the scope of this article. As a proxy, the wage index was computed for the hypothesized high- and low-wage labor market areas and compared across each of the alternatives.

Criterion 3: Are the new labor market areas of reasonable size across the country?—New labor market areas should be constructed using variables that reasonably subdivide the current labor market areas across the country. Because of differences in population density and distribution, county size, and other factors, a system that works well in one area may not be appropriate in other areas.

To evaluate the size of labor market areas, a minimum of five hospitals was selected to identify labor market areas with a reasonable cell size; those with fewer than five hospitals were considered to have a small cell size. The number of labor market areas with small cell size was evaluated for their geographic distribution.

Criterion 4: Is distributional equity improved?—When evaluated in concert with other payment adjustments, the new labor market areas should also improve overall payment equity. Although new labor market areas will redistribute funds across individual hospitals, such redistribution should not overcompensate or undercompensate high-wage hospitals relative to low-wage hospitals.

To evaluate distributional equity, wage indexes were developed using the alternative labor market areas and analyzed in the payment simulation model to determine payment-to-cost ratios, described in a separate article in this issue of the *Review* (O'Dougherty et al., 1992). Using a single-rate system, payment-to-cost ratios of the alternative labor market areas were compared with the current labor market areas for particular categories of hospitals to determine if any of the alternative labor market areas improved payment equity.

Findings

Rural labor market areas

Four alternative rural labor market areas were examined. Each divides the rural counties within a State into two or more labor market areas. Each alternative clusters rural counties according to certain characteristics that reflect degrees of urbanization (such as population size or proximity to an MSA). The hypothesis is that urbanization is associated with an increased cost of living in general and hospital labor costs in particular. To the extent that the cost of labor for rural hospitals varies significantly within a State in relation to these criteria, labor market areas based on them should improve the ability of the wage index to accurately reflect wage variation. The four alternatives examined are as follows:

- City population—Divides the rural counties of each State into those with and without a city population of 25,000 or more (Schmitz and Merrell, 1987).
- County population—Similar to city population, except that it would divide counties based on whether or not the total county population exceeds 25,000 (Williams, Pettengill, and Lisk, 1990).
- Adjacent county—Divides the rural counties of each State into those that are adjacent or non-adjacent to an MSA (Cromwell, Hendricks, and Pope, 1986).
- Adjacent-population—Combines the second and third alternatives. That is, the rural counties of each State would be divided into four labor market areas: (1) adjacent counties with a population of 25,000 or more, (2) adjacent counties with a population of less than 25,000, (3) non-adjacent counties with a population of 25,000 or more, and (4) non-adjacent counties with a population of less than 25,000.

Evaluation of criterion 1—The labor market area definition that appeared to explain the highest percentage of labor costs was adjacent-population followed by county population. Table 1 illustrates the ability of each alternative to explain variation in hospitals' average hourly wage (measured by R^2). (Adjusted R -square values were also calculated. The differences were small and did not change the relative explanatory power of the various labor market areas.) The adjacent county alternative slightly outperforms

Table 1
Rural labor market area alternatives

Alternative	Number of hospitals	R ²	F value	Mean wage-index value	Percent difference in mean wage index
City population	—	.44	22.2	—	—
25,000 or more	213	—	—	0.8719	6.6
Less than 25,000	2,223	—	—	0.8139	—
County population	—	.48	24.7	—	—
25,000 or more	1,179	—	—	0.8520	11.5
Less than 25,000	1,365	—	—	0.7542	—
Adjacent county	—	.43	20.8	—	—
Adjacent	1,268	—	—	0.8396	3.9
Non-adjacent	1,260	—	—	0.8061	—
Adjacent-population	—	.49	14.1	—	—
Adjacent 25,000 or more	736	—	—	0.8619	13.1
Adjacent less than 25,000	522	—	—	0.7603	—
Non-adjacent 25,000 or more	429	—	—	0.8371	—
Non-adjacent less than 25,000	830	—	—	0.7493	—
Current labor market areas	2,383	.42	39.7	0.8212	—

NOTES: The mean wage-index value is case-weighted and normalized to 1.00. For some hospitals, there was no labor market area assignment readily available. Therefore, the number of hospitals may differ between the current labor market areas and each alternative.

SOURCES: Health Care Financing Administration, Bureau of Data Management and Strategy: Data development by Office of Research. County designations for the city population and county population alternatives provided by the Prospective Payment Assessment Commission; county designations for the adjacent county alternative (Cromwell, Hendricks, and Pope, 1986).

the current statewide rural labor market areas. For comparison purposes, it is noteworthy that none of the rural alternatives explains wage variation as well as the current urban labor market areas where the R² is .68.

Evaluation of criterion 2—The ability of each alternative to differentiate between high- and low-wage hospitals, separating them into different labor market areas, was also evaluated (Table 1). This is measured by the average difference in the wage indexes of the high- and low-wage areas of each alternative (as a percent of the high-wage area). Across all rural hospitals, adjacent-population, followed by county population, best distinguishes between high- and low-wage labor market areas.

The alternative labor market areas appear to be reasonable based on hospital wages. However, because they are all based on counties, problems of county size occur in all alternatives. That is, in a large county with a number of hospitals, some of which pay high wages and others of which pay low wages, none of the four alternatives are able to separate the high- and low-wage hospitals. County population has the fewest number of States (one) where the hypothesized lower wage area has a higher wage-index value than the hypothesized high-wage area (Table 2). Adjacent-population was not evaluated on this criterion because it is not clear, a priori, how the four labor market areas should be arrayed in terms of high- and low-wage areas.

Evaluation of criterion 3—The ability of each alternative labor market area to subdivide the current rural labor market areas across the country into reasonably sized groups (five or more hospitals) was evaluated. This was especially a concern for the city population alternative because of the small number of hospitals in a rural county with a city of at least 25,000

(only 213 hospitals were in such a county across the country). Small cell size was a problem for city population; only 20 States had 5 or more hospitals in such a county. This was particularly true west of the Mississippi River, where rural counties, and especially rural towns, tend to be less densely populated. The adjacent-population alternative also had a problem with small cell size because it subdivides each State into four labor market areas. Only 18 States had 5 or more hospitals in each of the 4 labor market areas. As might be expected, these 18 States tend to be those with a large number of rural hospitals, fairly even population distribution, and clustered in the middle areas of the country.

Evaluation of criterion 4—The impact of each alternative labor market area in a single-rate system was assessed in a payment simulation model described in a separate article in this issue of the *Review* (O'Dougherty et al., 1992). Compared with the current labor market areas, all of the alternative labor market areas improve equity in a single-rate system (Table 3). County

Table 2
States with higher wage-index value in hypothesized lower wage area

Alternative	Number and States
City population	3 (WA, NY, HI)
County population	1 (VA)
Adjacent county	15 (AL, CO, GA, IA, KY, MI, MT, NY, NC, ND, SC, SD, VT, WV, WI)

NOTE: Postal Service style of two-letter abbreviations for States are shown.

SOURCES: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the 1988 Hospital Wage Survey; data development by Office of Research. County designations for the city population and county population alternatives provided by the Prospective Payment Assessment Commission; county designations for the adjacent county alternative (Cromwell, Hendricks, and Pope, 1986).

Table 3
Rural hospital simulation results, payment-to-cost ratios

Alternative	Number of hospitals (1)	Fiscal year 1995 current law (2)	Single rate, current LMAs (3)	Single rate, alternative LMAs (4)
City population				
25,000 or more	195	0.9580	0.9599	0.9948
Less than 25,000	2,038	1.0228	1.0274	1.0203
County population				
25,000 or more	1,077	0.9969	1.0022	1.0162
Less than 25,000	1,243	1.0543	1.0555	1.0211
Adjacent county				
Adjacent	1,163	0.9956	1.0000	1.0049
Non-adjacent	1,156	1.0308	1.0346	1.0356
Adjacent-population				
Adjacent 25,000 or more	673	0.9864	0.9906	1.0024
Adjacent less than 25,000	472	1.0353	1.0408	1.0157
Non-adjacent 25,000 or more	391	1.0137	1.0205	1.0384
Non-adjacent less than 25,000	753	1.0717	1.0692	1.0273

NOTES: For some hospitals, there was no alternative labor market area assignment readily available. Therefore, the number of hospitals may differ between the current labor market areas and each alternative. LMAs are labor market areas.

SOURCES: Health Care Financing Administration, Bureau of Data Management and Strategy; Data development by Office of Research. County designations for the city population and county population alternatives provided by the Prospective Payment Assessment Commission; county designations for the adjacent county alternative (Cromwell, Hendricks, and Pope, 1986).

population brings the ratios close to 1.00 for both high- and low-wage areas followed closely by adjacent county, adjacent-population, and city population.

Column 2 of Table 3 shows the payment-to-cost ratios under FY 1995 current law, for statewide rural hospital labor market areas, after elimination of the separate rural amount. Column 3 shows the ratios under a single rate PPS without changing any other adjustments (i.e., the current rural and urban labor market areas are used). Last, column 4 shows the ratios using alternative labor market areas with a single PPS rate; four separate payment simulations were run, employing each of the four alternative rural labor market areas.

Discussion

On balance, after evaluating the four alternative rural labor market areas across the four criteria, the county population alternative is preferable. It is second only to adjacent-population in terms of increase in explanation of wage variation and it yields reasonably sized labor market areas across the country. Although it is more vulnerable to differences in county size than the city population alternative, it outperforms city population in terms of explaining wage variation and improvement in payment equity. Moreover, the U.S. Bureau of the Census updates population estimates for rural counties every year, permitting a redefinition of rural labor market areas on a timely basis.

Urban labor market areas

Four alternative urban labor market areas were examined. Each divides MSAs into two units based on proximity to the core of the MSA using various geographic criteria (such as population density and county or city boundaries). The hypothesis is that urbanization is associated with an increased cost of

living in general and hospital labor costs in particular. To the extent that the cost of labor for urban hospitals varies significantly within an MSA in relation to these criteria, labor market areas based on them should improve the ability of the wage index to accurately reflect wage variation.

The alternatives are based on the simplifying assumption that an MSA is a circle with the most urban area at the center surrounded by concentric rings that are less urban as distance from the center increases. This model of an MSA may be more applicable in some parts of the country (such as older MSAs with a downtown core and smaller, more suburban towns on the periphery) than others. Some MSAs (without a single downtown core such as Los Angeles or Houston), do not follow this pattern of urbanization and may have several "mini" downtowns throughout a large metropolitan area. The extent to which the alternatives accurately distinguish between urban core and suburban ring areas of MSAs, and presumably high- and low-wage hospitals, may vary depending on the configuration of each MSA. The four alternatives examined are as follows:

- **Urbanized**—Urbanized areas are defined by the U.S. Bureau of the Census based on census tracts with a population density of 1,000 persons or more per square mile. Areas in an MSA with a lower population density are considered non-urbanized (Schmitz and Merrell, 1987).
- **Central county**—Central and outlying counties are defined by the U.S. Bureau of the Census. Central counties have 50 percent of their population in an urbanized area or contain the central city. Outlying counties are added to an MSA based on commuting, population density, and other criteria (Williams, Pettengill, and Lisk, 1990).
- **Core county**—Counties are considered core if they have the largest population density in the MSA,

weighted by population at the ZIP Code level, or if they exceed a fixed threshold of 3,500 persons per square mile. Other counties in the MSA are considered non-core (Welch and Zuckerman, 1991).

- Core city—Core or central city is defined by the U.S. Bureau of the Census. Other parts of the MSA are considered suburban ring (Cromwell, Hendricks, and Pope, 1986).

Each of the four alternative urban labor market areas divides the current MSAs into two units with the exception of core county; it only subdivides consolidated metropolitan statistical areas (CMSAs) with populations of 1 million or more. A CMSA is a combination of two or more adjacent MSAs. An

example of a CMSA is the Baltimore, Maryland-Washington, DC area. (There are 207 hospitals in CMSAs with populations of 1 million that are not in an MSA with a population of 1 million—32 of these hospitals are in core counties.)

Evaluation of criterion 1—The labor market area definition that appeared to explain the highest percentage of labor costs was core city, followed by central county and core county (Table 4). These three alternatives would be an improvement over the current labor market area definition in terms of explaining wage variation among hospitals in MSAs with populations of 1 million or more. Urbanized does not

Table 4
Urban labor market area alternatives: CMSAs with populations of 1 million or more

Alternative	Number of hospitals	R ²	F value	Mean wage-index value	Percent difference in mean wage index
Urbanized	—	.56	25.4	—	—
Urban	1,292	—	—	1.0084	12.6
Non-urban	193	—	—	0.8810	—
Central county	—	.59	20.0	—	—
Central	1,394	—	—	1.0076	13.6
Outlying	124	—	—	0.8703	—
Core county	—	.58	18.7	—	—
Core	1,047	—	—	1.1466	6.5
Non-core	569	—	—	1.0722	—
Core city	—	.61	12.4	—	—
Core	661	—	—	1.0036	1.4
Ring	863	—	—	0.9895	—
Current labor market areas	1,619	.56	25.4	1.0000	—

NOTES: For some hospitals, there was no alternative labor market area assignment readily available. Therefore, the number of hospitals may differ between the current labor market areas and each alternative. Unlike the other tables where all hospitals are included, to compare the four alternatives across the same set of hospitals, only about 1,600 hospitals are included in this table. The wage-index values would vary somewhat if all hospitals were included in this table, because each index is case-weighted and normalized to 1.000. CMSAs are consolidated metropolitan statistical areas.

SOURCES: Health Care Financing Administration, Bureau of Data Management and Strategy: Data development by Office of Research. Designations for the urbanized and central county alternatives provided by the Prospective Payment Assessment Commission; designations for the core county alternative (Welch and Zuckerman, 1991); those for the core city alternative (Cromwell, Hendricks, and Pope, 1986).

Table 5
Urban labor market area alternatives: All metropolitan statistical areas (MSAs)

Alternative	Number of hospitals	R ²	F value	Mean wage-index value	Percent difference in mean wage index
Urbanized	—	.68	17.0	—	—
Urban	2,174	—	—	1.0601	11.5
Non-urban	430	—	—	0.9383	—
Central county	—	.71	14.2	—	—
Central large MSA	1,682	—	—	1.1044	15.3
Outlying	202	—	—	0.9351	—
Central small MSA	835	—	—	0.9565	11.2
Outlying	101	—	—	0.8493	—
Core city	—	.73	10.3	—	—
Core	1,335	—	—	1.0376	-2.5
Ring	1,340	—	—	1.0637	—
Current labor market areas	2,890	.68	17.0	1.0518	—

NOTES: For some hospitals, there was no alternative labor market area assignment readily available. Therefore, the number of hospitals may differ between the current labor market areas and each alternative.

SOURCES: Health Care Financing Administration, Bureau of Data Management and Strategy: Data development by Office of Research. Designations for the urbanized and central county alternatives provided by the Prospective Payment Assessment Commission; designations for the core county alternative (Welch and Zuckerman, 1991); those for the core city alternative (Cromwell, Hendricks, and Pope, 1986).

explain any more variation than the current labor market areas. In order to compare all four alternatives across the same set of hospitals, Table 4 is limited to those hospitals with valid data on the core county alternative, which is to say those in CMSAs with populations of 1 million or more. The current MSA labor market areas explain 56 percent of the wage variation among this group of urban hospitals in large cities (compared with 68 percent for all urban hospitals).

Evaluation of criterion 2—The ability of each alternative to differentiate between high- and low-wage hospitals, separating them into different labor market areas, was also evaluated (Table 4). This is measured by the average difference in the wage indexes of the high- and low-wage areas of each alternative (as a percent of the high-wage area). Across urban hospitals, central county, followed by urbanized, best distinguishes between the high- and low-wage labor market areas. Core county and core city are not particularly successful here.

The three labor market area alternatives that subdivide all MSAs are compared in Table 5 (core county is excluded). The findings are similar to those described for Table 4, except that the degree of wage variation explained is much higher. Core city is again the best predictor of wage variation. When smaller MSAs are also subdivided by core city, the magnitude of the difference between hypothesized high- and low-wage areas is about the same as previously noted for large MSAs (-2.5 percent versus 1.4 percent). However,

the suburban ring has a higher average wage than the urban core.

The number of labor market areas where the hypothesized low-wage area actually had a higher wage-index value than the expected high-wage area was evaluated. The MSAs with higher wages in the outlying areas vary across the four alternatives. Table 6 indicates that the urbanized and central county alternatives minimize the number of outlying areas with higher wages (13 percent of subdivided MSAs for both alternatives). Surprisingly, core city has the highest percentage (25 percent) of outlying areas with higher wage-index values than the urban core. This is surprising because core city has the narrowest geographic definition of urban core and hence the highest degree of urbanization.

A more definitive assessment of the reasonableness of the boundaries based on hospital wages would require a comparison of average hourly wages across hospitals near the boundary of each subdivision, a task beyond the scope of this article. As a proxy, MSAs with selected characteristics were examined. Table 7 displays the number of urban hospitals assigned to outlying labor market areas for five MSAs. Under all alternatives except core city, the three largest MSAs have very few hospitals in the outlying area. Of the 57 hospitals in the New York City MSA, only 2 are in each of 2 outlying counties. Population density is not high enough in urbanized areas to permit reasonably sized outlying labor markets in the largest, most densely populated MSAs. MSAs that are less densely populated and composed of numerous counties, such as Atlanta and

Table 6
Subdivision of urban labor market area alternatives

Alternative	Number of MSAs	Higher outlying area wage		Small cell size	
		Number	Percent	Number	Percent
Urbanized	54	7	13	39	72
Central county	30	4	13	19	63
Core county	34	7	21	8	24
Core city	64	16	25	26	41

NOTES: Eighty MSAs were available to be subdivided within CMSAs of 1 million population or more. MSAs are metropolitan statistical areas. CMSAs are consolidated metropolitan statistical areas.

SOURCES: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the 1988 Hospital Wage Survey; data development by Office of Research. Designations for the urbanized and central county alternatives provided by the Prospective Payment Assessment Commission; designations for the core county alternative (Welch and Zuckerman, 1991); those for the core city alternative (Cromwell, Hendricks, and Pope, 1986).

Table 7
Number of urban hospitals in outlying labor market areas

Metropolitan statistical area	Number of hospitals	Alternatives			
		Urbanized	Central county	Core county	Core city
New York	57	1	2	2	12
Chicago	70	4	3	8	31
Los Angeles	109	4	0	0	80
Atlanta	39	6	11	20	25
Minneapolis-St. Paul	33	17	12	19	21

NOTES: This table includes hospitals for which labor market area assignment was readily available. There may be more prospective payment system hospitals in the metropolitan statistical area.

SOURCES: Health Care Financing Administration, Bureau of Data Management and Strategy: Data from the 1988 Hospital Wage Survey; data development by Office of Research. Designations for the urbanized and central county alternatives provided by the Prospective Payment Assessment Commission; designations for the core county alternative (Welch and Zuckerman, 1991); those for the core city alternative (Cromwell, Hendricks, and Pope, 1986).

Minneapolis-St. Paul, are more easily subdivided into reasonably sized units.

Evaluation of criterion 3—The ability of each alternative labor market area to subdivide the current labor market areas across the country was evaluated for CMSAs with populations of 1 million or more (Table 6). Many of the smaller MSAs have from 4 to 10 hospitals, so the majority would have small-cell-size problems under any labor market area alternative. Small cell size was especially a concern for urbanized and central county alternatives because they each have a small number of hospitals in the outlying labor market areas (in CMSAs with populations of 1 million or more, there are 193 hospitals in non-urbanized areas and 124 hospitals in outlying counties).

Small cell size was a problem for several of the alternatives, especially for the labor market areas based on counties. MSAs vary significantly in terms of the number of counties, and counties also vary in terms of geographic area. For instance, the State of Georgia has 159 counties, and California, a much more populous and geographically larger State, has 59 counties. In addition, the population of an MSA often bears little relationship to the number of counties it contains. For example, the Los Angeles and Miami MSAs each have 1 county and the Chicago MSA has 3 counties, whereas the MSAs of Atlanta and Minneapolis, which have smaller populations, have a larger number of counties, 18 and 11, respectively.

Each labor market area alternative did not subdivide each MSA (Table 6). As might be expected, urbanized and core city are most likely to subdivide an MSA because they are not based on counties. Core county is best in terms of subdividing MSAs into reasonably sized pieces: Only 24 percent of the MSAs that it subdivides have a labor market area with a small-cell-size problem.

However, core county subdivides less than one-half of the CMSAs with populations of 1 million or more.

Evaluation of criterion 4—The impact of each alternative labor market area in a single-rate system was assessed in a payment simulation model described in a separate article in this issue of the *Review* (O'Dougherty et al., 1992). Compared with the current labor market areas, core county and core city improve equity in a single-rate system. Urbanized and central county disadvantage outlying areas relative to the current labor market areas and reduce payment-to-cost ratios below the national average.

Column 2 of Table 8 shows the payment-to-cost ratios under FY 1995 current law, including MSA urban labor market areas, after elimination of the separate rural amount. Column 3 shows the ratios under a single rate PPS without changing any other adjustments (i.e., the current rural and urban labor market areas are used). Finally, column 4 shows the ratios using alternative labor market areas with a single rate PPS: Four separate payment simulations were run, employing each of the four alternative urban labor market areas.

Discussion

None of the alternative urban labor market areas are clearly superior to the others. Core city explains the greatest amount of variation in hospital wages. However, 25 percent of the large MSAs that core city subdivides have ring areas with higher wage-index values than do the core areas. The hypothesis that urbanization is associated with hospital wages is not confirmed with this alternative. This is particularly troubling because core city has the narrowest geographic definition of urban core. This suggests that

Table 8
Urban hospital simulation results, payment-to-cost ratios

Alternative	Number of hospitals (1)	Fiscal year 1995, current law (2)	Single rate, current LMA (3)	Single rate, alternative LMA (4)
Urbanized				
Urban	1,984	0.9987	0.9979	0.9982
Non-urban	423	1.0039	1.0069	0.9799
Central county				
Central large MSA	1,498	0.9924	0.9883	0.9844
Outlying large	190	1.0249	1.0280	0.9969
Central small MSA	758	1.0105	1.0181	1.0308
Outlying small	92	1.0083	1.0192	0.9938
Core county				
Core	909	1.0022	0.9932	1.0004
Non-core	522	0.9742	0.9766	0.9893
Core city				
Core	1,193	1.0122	1.0111	1.0082
Ring	1,249	0.9656	0.9659	0.9746

NOTES: For some hospitals, there was no alternative labor market area assignment readily available. Therefore, the number of hospitals may differ between the current labor market areas and each alternative. LMA is labor market area. MSA is metropolitan statistical area.

SOURCES: Health Care Financing Administration, Bureau of Data Management and Strategy; Data development by Office of Research. Designations for the urbanized and central county alternatives provided by the Prospective Payment Assessment Commission; designations for the core county alternative (Welch and Zuckerman, 1991); those for the core city alternative (Cromwell, Hendricks, and Pope, 1986).

more refined hypotheses are needed that account for factors other than urbanization.

Surprisingly, there was an inverse relationship between the breadth of urbanization and expected performance on evaluation criteria 1 and 2. Using a narrow definition of urban core (such as core city) increases the explanation of wage variation but decreases the difference between high- and low-wage areas. Using a broad definition of urban core (such as urbanized) results in no improvement in the explanation of wage variation but increases the difference between high- and low-wage areas.

Central county is the best in terms of the average percentage difference between high- and low-wage hospitals. However, both urbanized and central county have very small outlying labor market areas in the major MSAs of New York City and Chicago. It makes little apparent sense to partition a large MSA into two units when one of the units contains about 5 percent of the hospitals. In addition, in terms of payment equity, all of the alternative labor market areas tend to disadvantage small urban hospitals, a group that already has relatively low payment-to-cost ratios (although not reported elsewhere, their ratios range from 0.93 to 0.95, compared with 0.96 with the current labor market areas).

As noted earlier, the current hospital labor market areas and their alternatives have been developed using existing political and geographic boundaries (i.e., city, county, State, and urbanized areas) that were not developed for this purpose. Although all of these labor market areas explain hospital wage variation to some degree, there is clearly room for improvement. Further research that examines alternative labor market areas for urban hospitals with particular attention to large MSAs is needed. Even though previous studies have found greater wage variation in smaller MSAs than found in large MSAs, to subdivide MSAs that contain only from 4 to 10 hospitals raises questions. It may be more likely that hospitals in these small MSAs draw workers from surrounding rural counties rather than from distinct labor market areas within the MSA. Distinct intra-MSA labor market areas may be more likely to exist in the largest MSAs. Data on commuting patterns would need to be examined to evaluate these hypotheses.

Summary and conclusion

The wage index adjustment to the standardized payment amounts is made by applying a single wage-index value for all of the hospitals located within a given labor market area. Each MSA is assumed to be a distinct urban labor market area, and all counties within the same State that are outside of MSAs are assumed to comprise a single rural labor market area. Efforts to improve the wage index have focused on the definitions of urban and rural labor market areas by dividing rural counties, based on either population or proximity to an urban area, and dividing urban areas, based on proximity to the MSA core area.

Four criteria were applied in the evaluation of the rural and urban labor market area alternatives. First, compared with the current labor market areas, new labor market areas should substantially improve the explanation of wage variation. Second, new labor market areas should improve upon the uniformity of the labor markets from which hospitals draw their workers. Third, new labor market areas should be built on variables that reasonably divide the current labor market areas across the country. Fourth, when evaluated in concert with other payment adjustments, the new labor market areas should improve overall payment equity in a single-rate system.

Of the four rural labor market alternatives examined, county population (which divides rural counties by population size) performed the best. Of the four urban labor market area alternatives examined, there was no clearly superior alternative. Additional research, with particular attention to large MSAs and hypotheses regarding wage variation in addition to urbanization, is needed before modifications are made to urban labor market areas. Although the alternative labor market areas for both urban and rural areas showed at least some improvement over the current labor market areas, all of the alternatives used readily available proxies, such as population size or density, in order to define hospital labor market areas. More direct measures of hospital labor market areas remain to be developed.

Despite the difficulties in defining hospital labor market areas, the two goals of cost containment and payment equity continue to motivate such efforts. One of the principles underlying PPS was to make an average payment for each inpatient hospital discharge, adjusted for factors known to affect costs, without regard to the actual costs of individual hospitals. The challenge of defining labor market areas is to make them small enough to capture only hospitals with similar wages (improve payment equity) but large enough so that no one hospital has undue influence on its wage-index adjustment (cost-containment incentives).

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