

Health, Poverty and Health Care Spending

Geographic differences in health status and health care spending reflect geographic differences in wealth and poverty.

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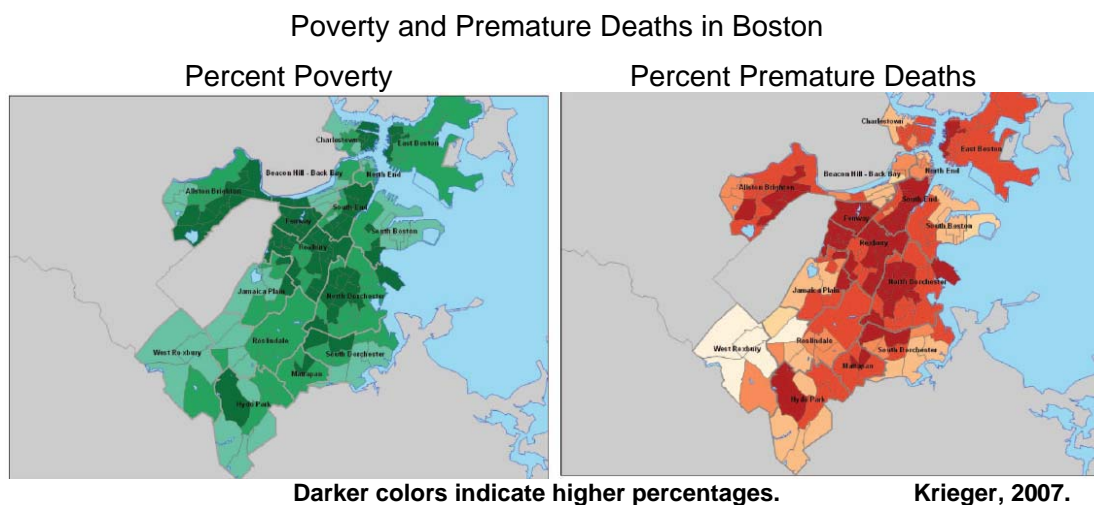
There is substantial geographic variations in health care utilization and spending in different parts of the country. However, when studied by the Dartmouth Health Policy Institute, whose Atlas of Health Care played a prominent role in health care reform, these differences have remained “unexplained,” even after accounting for the effects of patients’ income and burden of disease. Lacking any other explanation, geographic differences have been attributed to waste and inefficiency in clinical practice.

Even before such geographic differences in health care were noted, a broad body of social sciences literature linked poor socioeconomic circumstances to poor health status and showed an association between poverty and premature death. For example, low-income individuals have higher rates of hypertension, diabetes and strokes, and they are consistently found to have more infant mortality, greater all-cause mortality and shorter life expectancy.

It is common knowledge that income is geographic. There are rich neighborhoods and poor ones, wealthy communities and less prosperous ones, economically-advanced states and states that lag in development. Logic dictates that, like the poverty underlying it, the prevalence of disease and the associated premature mortality should follow geographic patterns. And because the prevalence of disease determines the magnitude of health care utilization, logic dictates that health care spending should follow these same geographic patterns in relation to poverty. In fact they do. **This report shows that health care utilization follows the geographic distribution of poverty, and, moreover, the added health care utilized by the poor accounts for approximately one-third of acute care hospital days.**

Spatial Pictures of Poverty, Poor Health and Health Care Utilization

The interrelationships between poverty and health outcomes are most often examined statistically. However, several prominent researchers have looked at them spatially. For example, Nancy Krieger from the Harvard School of Public Health found a striking overlap in the spatial distribution of poverty and of premature deaths in Boston (shown below) (1). Similar patterns were found in Alameda County CA by Bohan and Kleffman and in Great Britain by Nakaya and Dorling, and researchers in Toronto found a same spatial overlap between poverty and the prevalence of diabetes.

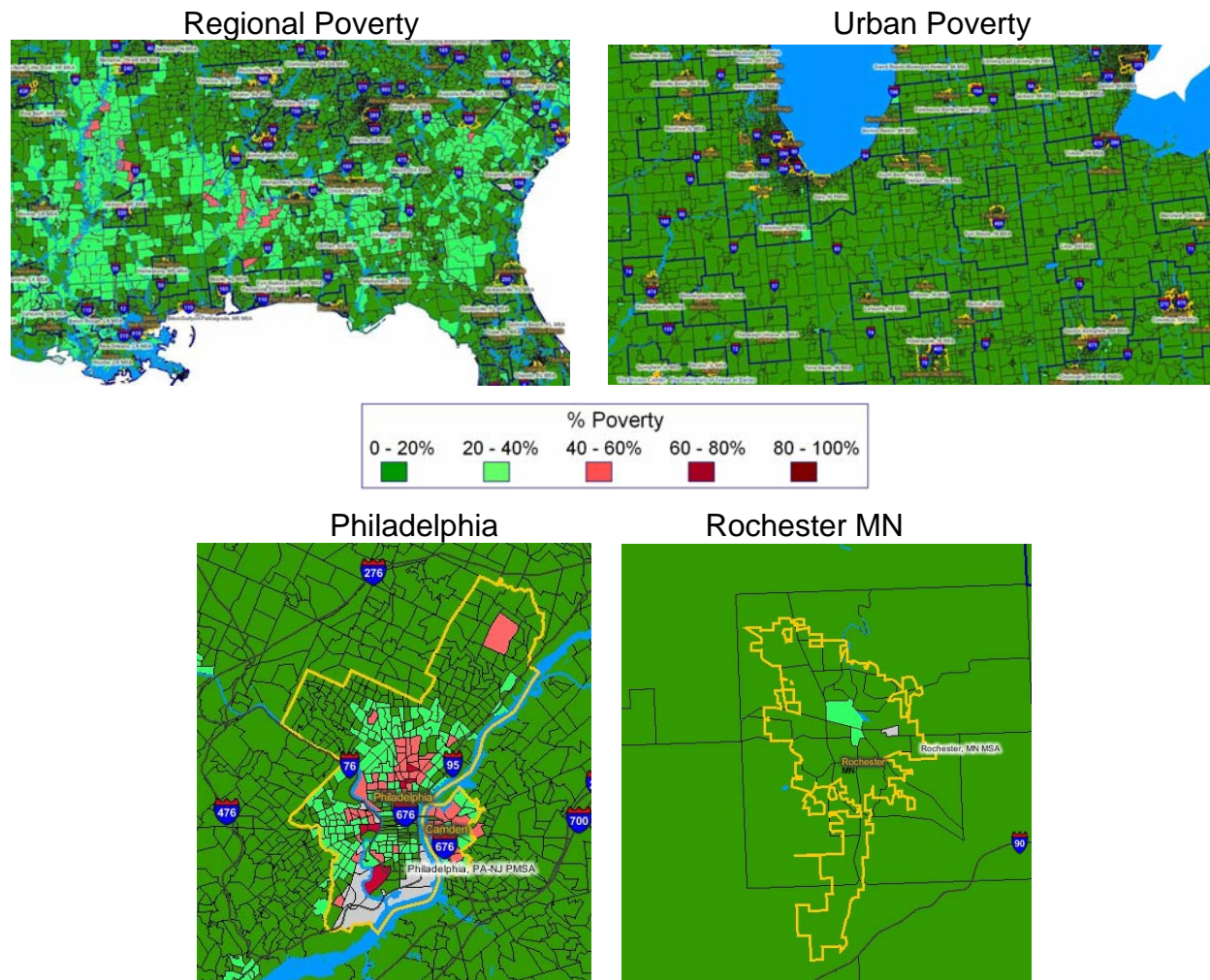


Poverty in America

It is clear that poverty distributes geographically and that health status follows accordingly, but what does this mean for the geographic variation in health care spending. Before considering this question, it is useful to examine the various ways that poverty is distributed across the US. The illustrations of poverty density throughout this report were derived from the 2000 Census, as mapped at the level of census tracts by the Bruton Center, University of Texas at Dallas.

As shown in the maps below, in some parts of the nation, poverty encompasses entire regions, particularly in the rural south and parts of the west. However, in the north, poverty exists most commonly as “poverty ghettos” within major urban centers, typically adjacent to areas of affluence, a pattern that I have termed the “Affluence-Poverty Nexus” (2). The former are readily

apparent in regional analyses of counties or hospital referral regions, as in the Dartmouth Atlas. The latter are simply obscured.



Philadelphia, shown above, is one example of an urban center with a poverty ghetto. Others include Atlanta, Boston, Chicago and New York (see Appendix), as well as Los Angeles and Milwaukee, which are analyzed in the sections that follow. Similar patterns are seen in some mid-sized cities, such as Tampa, New Haven and Sacramento, although not in some others, such as Seattle and Portland, but concentrated zones of poverty are generally not found in smaller communities, such as Rochester MN (illustrated above), Danville PA, Hanover NH, Grand Junction CO, Iowa City IA and Green Bay WI (see Appendix), all of which have been held out as having “efficient” health care systems (e.g., Mayo Clinic, Geisinger Clinic, Intermountain Health Care and Dartmouth-Hitchcock Hospital). All are illustrated in the Appendix.

Properly Accounting for Poverty

According to researchers associated with the Dartmouth Institute, regional differences in poverty and income explain almost none of the variation in health care spending. Why is this so, particularly since the relationships are so striking when displayed spatially?

The failure to detect the effects of poverty in previous studies of geographic variation is due, in large part, to two statistical anomalies. Each confounds conclusions that are rely upon aggregating and averaging the populations of large geographic units, such as counties, hospital referral regions (HRRs) (10 times the size of most counties) and states (10 times the size of most HRRs):

First, the populations of most large geographic regions are not homogeneous with respect to income. While rural regions tend to be more homogeneous, major urban centers are not. The statistical problem is that relatively small numbers of affluent individuals can cause over-estimates of mean or median income and, therefore, under-estimates of the numbers of individuals who are low-income.

Second, health care utilization is not distributed randomly across the population. Rather, the top 1% of the population in terms of utilization consumes 25%, the top 5% consumes 55% and the half that utilizes the least health care consumes only 3% of the whole, and, as will be discussed, high utilization occurs disproportionately among low-income individuals. As a result, relatively small numbers of low-income residents can lead to over-estimates of average health care utilization.

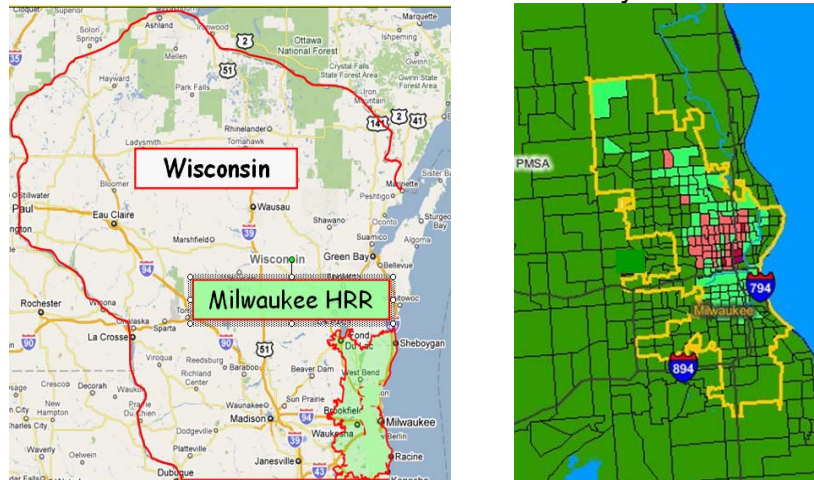
Thus, two systematic errors plague studies of geographic variation: poverty is under-estimated and utilization in relation to income is over-estimated. While various statistical maneuvers have been employed to correct for these anomalies, the only valid way to do so is to study geographic units that are sufficiently small and homogeneous so that statistically corrections are not required. As indicated, the 306 HRRs that constitute the Dartmouth Atlas are too large, and while smaller, the approximately 3,000 counties are still too large. Census tracts are best. There are more than 100,000, and they are constructed by the Census Bureau according to demographic characteristics, but health care data are seldom available at this level. The next best are the 43,000 ZIP codes. While many include economically-diverse populations, most are sufficiently

homogeneous to allow the income characteristics of the *population* to be taken as reflecting the economic characteristics of *patients* and of the *social environment* in which they live (education, transportation, access to food and pharmaceuticals, neighborhood safety, family support, etc.).

Milwaukee

A good starting point for understanding the important relationships between income and health care utilization is Milwaukee. Health care spending in the Milwaukee HRR is 25-30% higher than in the other HRRs in Wisconsin, a matter of concern to health care leaders in community. As seen in map below, poverty is concentrated in Milwaukee. Indeed, Milwaukee is the third most segregated city in the nation (behind Detroit and Gary Indiana). This is clearly detrimental to its social fabric, but it facilitates geographic assessments.

Wisconsin and the Milwaukee HRR Poverty in Milwaukee

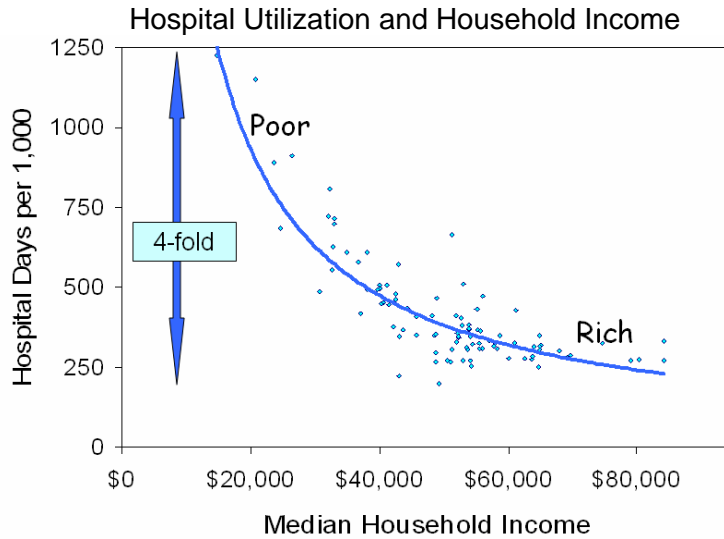


Household Income and Hospital Days in Milwaukee ZIP Codes

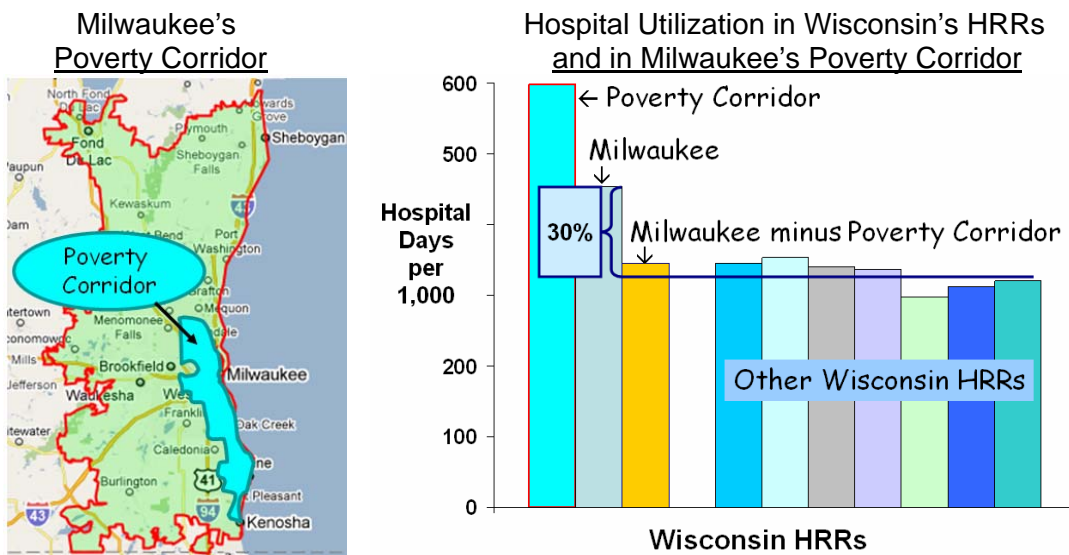
An explanation for the increased utilization of hospital services in Milwaukee begins to unfold when the Milwaukee HRR is broken down into its more than 100 ZIP codes. The graph below relates the rate of hospital utilization among adults ages 18-64 to the median household income in each ZIP code. It reveals two important facts.

First, health care utilization is much higher in poor ZIP codes than in rich ones. In fact, utilization by residents of the lowest-income ZIPs was 4-fold that of residents in the most affluent. However, there is little difference between the middle-income ZIPs and the highest.

Second, the statistical correlation between income and utilization is very strong ($r^2 = 0.7$). Similar results were observed in the Medicare population, although the magnitude of differences between poor and rich was less and the correlation weaker.



Because Milwaukee is so highly segregated, its low-income ZIP codes are clustered in a “poverty corridor,” illustrated below, that includes 43% of the population but 86% of the black and Latino populations. How much of the higher utilization in Milwaukee is accounted for by the higher utilization in the poverty corridor?



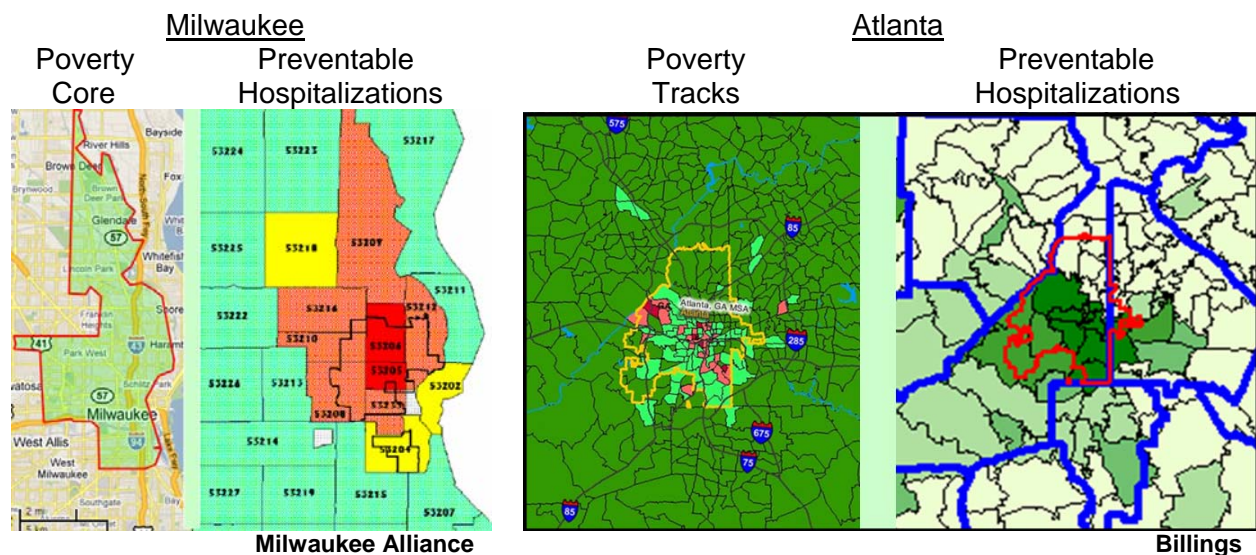
The answer is, essentially all. As shown in the bar graph above, health care utilization in Milwaukee is 33% greater than in the other HRRs in Wisconsin. However, when the poverty

corridor is excluded, health care utilization in the remainder of the Milwaukee HRR is no different than in other HRRs within the state. But the poverty corridor is very different. Per capita utilization is 74% greater than in the remainder of Milwaukee and 82% greater than the average of other HRRs in Wisconsin.

Without such insight, the differences between Milwaukee and other parts of Wisconsin might have been attributed to “waste and inefficiency.” Yet the actual reason for greater utilization is that low-income individuals have greater needs and consume more health care services. As is typical of urban areas, the Milwaukee HRR includes populations of both rich and poor. Its affluent population accounts for its higher than average level of wealth, 20% higher than the rest of the state (38% higher when the poverty corridor is excluded), while residents of its poverty corridor account for its greater utilization of health care, 33% greater than the rest of the State. **If the rate of utilization in the poverty corridor were the same as elsewhere in Milwaukee, the entire adult population (seniors included) would utilize approximately 30% fewer days.**

Preventable Hospital Admissions

A major reason for the increase in hospital utilization in Milwaukee’s poverty core is a greater number of “preventable admissions.” This term refers to admissions for chronic disorders, such as diabetes, congestive heart failure and chronic obstructive pulmonary disease (COPD), most of which are readmissions following a hospital stay within the previous month.



Hospital days for “preventable admissions” were increased more than 5-fold in the poverty corridor as compared with the Milwaukee’s most affluent areas. Independent studies by the Milwaukee Alliance found that preventable hospitalizations for pregnancy-related reasons were also greatly increased, especially in the “core” area of greatest poverty, as shown below. And in a like manner, Billings (3), who previously had reported a strong statistical relationship between low-income neighborhoods and higher rates of preventable admissions, found a spatial pattern for preventable hospitalizations in Atlanta that is very similar to the spatial distribution of poverty.

Los Angeles

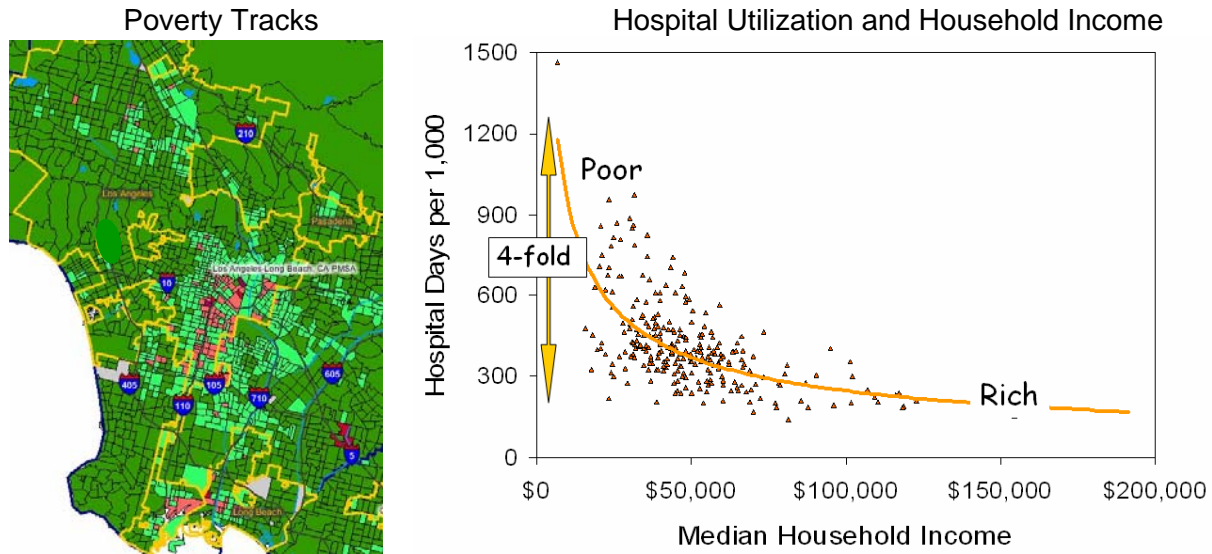
The Los Angeles HRR, which encompasses Los Angeles County, is the most populous in the nation, five times size of the Milwaukee HRR and more populous than Chicago, Miami-Dade County and Manhattan combined. It contains three-times as many ZIP codes as Milwaukee.

Los Angeles has among the highest per capita rates of health care spending in the nation, 30% higher than the national average and 39% higher than the average of the other HRRs in California. To what extent does its low-income population account for these large differences?

To begin to answer this question, the same analyses of ZIP code income and hospital utilization that were carried out for Milwaukee were applied to hospital data from Los Angeles. Because of its population is larger and denser, it was possible to separately-analyze younger adults (ages 18-44) and older adults (ages 45-64). The data shown are for this latter group.

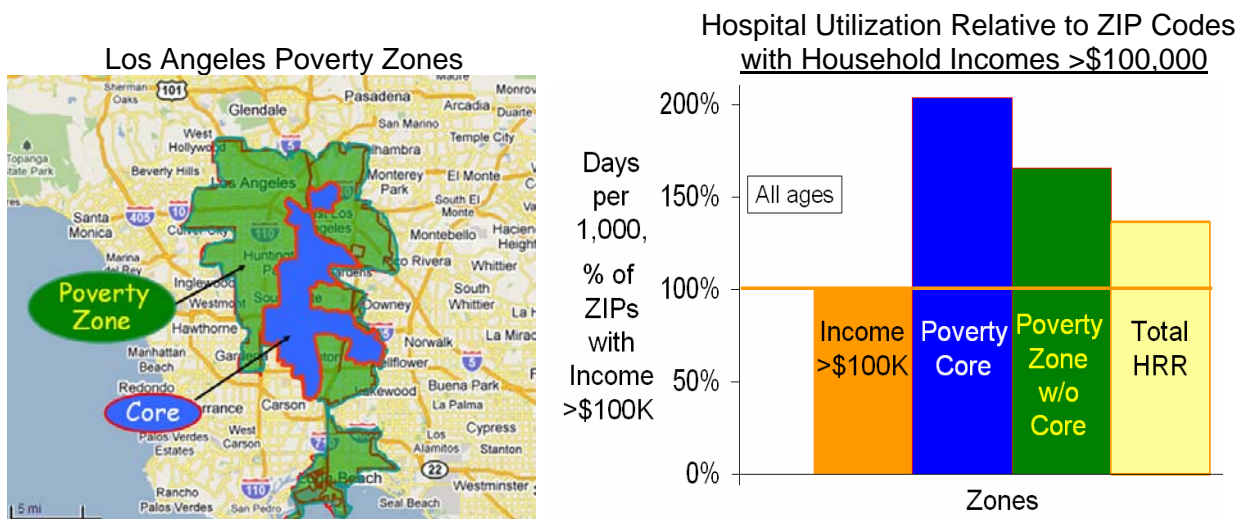
As illustrated in the graph below, the results of a regression analysis are remarkably similar to those observed in Milwaukee. As in Milwaukee, health care utilization is much higher in low-income ZIP codes than in affluent ones. In fact, like Milwaukee, utilization by residents of the lowest-income ZIPs was 4-fold that of the highest, with little difference between middle-income and high-income ZIPs. The correlation coefficient ($r^2 = 0.45$), although lower than in Milwaukee, was strong. And as also observed in Milwaukee, there was more scatter of the data points in the Medicare age group and the magnitude of differences between poor and rich was somewhat less.

Poverty and Hospital Utilization in Los Angeles



Los Angeles Poverty Zones

Like Milwaukee, Los Angeles has a dense zone of poverty and a core of extreme poverty within it, as shown in the illustration below. But unlike Milwaukee, it also has many other clusters of poverty, as shown on the map of poverty tracks above. As a result, it was not possible to create a standard of utilization that is relatively free of poverty by simply subtracting the zone of greatest poverty, as was done in Milwaukee. Instead, a standard of ZIP codes relatively free of poverty was created from all of the ZIP codes in which household incomes were greater than \$100,000. Utilization rates other zones were compared to that standard.



As shown in the bar graph above, utilization in the poverty core (which includes approximately 5% of the adult population) was more than double the rate in the affluent ZIPs. Utilization in the

surrounding poverty zone (which includes an additional 20% of the population) was increased by 65%. Utilization in the entire HRR (including high-income ZIPs) was 36% greater than in the high-income ZIPs alone. **Thus, if utilization in all ZIP codes were at the rate of utilization in Los Angeles' most affluent ZIP codes, 36% fewer hospital days would be utilized.**

Los Angeles differed from Milwaukee in another instructive way. Because Milwaukee is so racially and economically segregated, there is minimal overlap between rich and poor populations within ZIP codes. That is not the case in Los Angeles. The physical terrain lends itself to the close juxtaposition of rich and poor neighborhoods. One example is Pasadena 91103, in which the Rose Bowl divides neighborhoods of extreme wealth and extreme poverty. High-utilization among the poor and high-income among the rich led to the same spurious result that was described earlier for larger regions, such as counties and HRRs, portraying the picture of an affluent area with high utilization. Thus, even at the ZIP code level, aggregation and averaging of non-homogeneous populations, particularly at the extremes of wealth, can lead the spurious conclusion about the association of income and health care utilization.

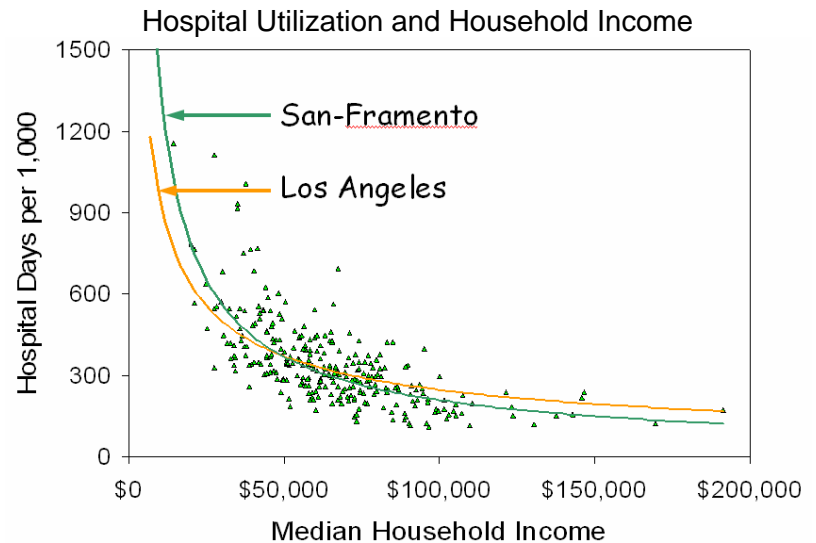
San Framento

California is the most populace state in the nation, accounting for more than 10% of the US population. Were it a country, it would rank 33rd in the world. Health care utilization varies widely. Among California's most populace counties, the number of hospital days per capita for adults ages 45-64 varies 45%, with Los Angeles having the most and neighboring Orange County the fewest. To create a region of California that is comparable in population to Los Angeles, an area was defined stretching from San Francisco to Sacramento, named "San-Framento." Its population is 90% of the population in Los Angeles, but its demographics are very different. Ethnically, it is 50% non-Hispanic white (vs. 31% in Los Angeles) and 20% Hispanic (vs. 45%). Its median household income is one-third higher than in Los Angeles, and its poverty rate is one-third lower.

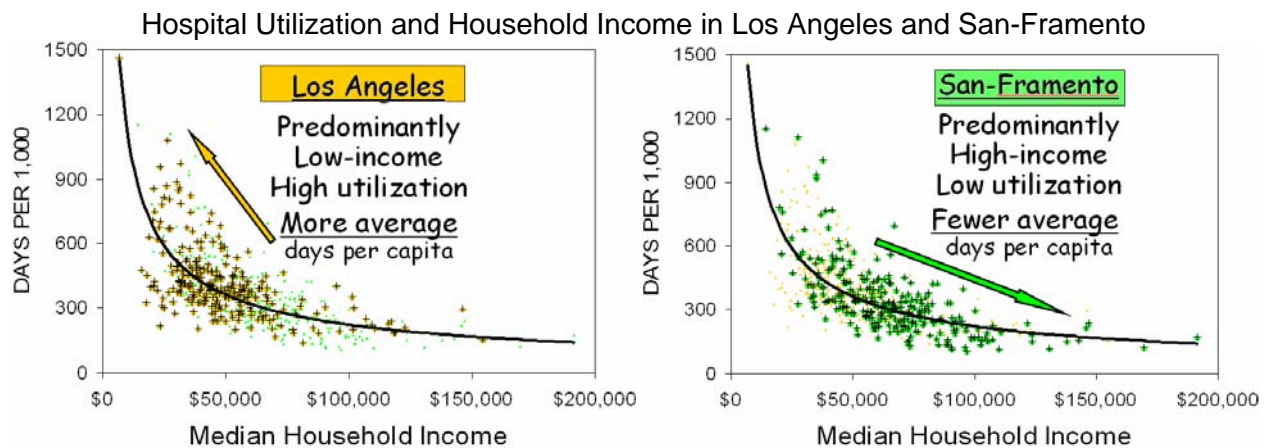
As measured both by the Dartmouth Atlas and the California Hospital data, seniors in San-Framento utilize 40% fewer acute care hospital days, and younger adults use 20% fewer. Yet, as shown above, despite marked differences in both demographic characteristics and hospital

utilization, the same relationship between hospital days and household income that was observed in Los Angeles was found in San-Framento, with an even stronger correlation coefficient ($r^2 = 0.54$). In accord with the observations made in both Milwaukee and Los Angeles, if the hospital utilization in all of San-Framento were at the rate observed in those ZIP codes with household incomes greater than \$80,000, San-Framento would utilize 26% fewer days.

Los Angeles and San-Framento



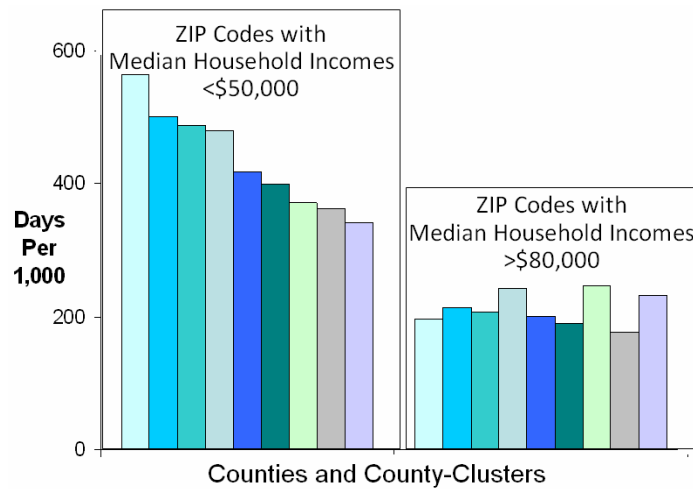
What, then, explains the much higher rates of utilization in Los Angeles than San Framento? Both have poor neighborhoods and neighborhoods of extreme wealth. As depicted in the graphs below, the fundamental difference between Los Angeles and San-Framento is that Los Angeles has more poor people relative to its affluent population while San-Framento has proportionately more who are wealthy.



Poverty in parts of Alameda County (in San-Framento) resembles Los Angeles' poorest neighborhoods, as the wealth in Marin and San Mateo Counties resembles its wealthiest, and hospital utilization rates follow accordingly. **The critical observation is that the level of health care utilization among the poor in Los Angeles and San-Framento is similar, as it is among the rich. Differences in health care utilization between these two regions relate to the relative mix of wealth and poverty.**

Wealth and Poverty among California's Counties

In Wisconsin, ZIP codes with extremes of wealth or poverty are largely confined to the Milwaukee HRR, but in California, ZIP codes with these extremes exist throughout many HRRs. This presented an opportunity to study geographic variation among ZIP codes at the extremes of income.



To create comparable units for comparison, each with sufficient population and economic diversity to permit analysis, California's eighteen most populace counties were collapsed into nine counties or clusters of adjacent counties. Considering all ZIP codes in each, the range of variation among these nine regions was 45%. When only ZIP codes with a median household income of less than \$50,000 were considered, the range of variation increased to 65% (shown in the left panel, above). In contrast, when only ZIP codes with household incomes of greater than \$80,000 were considered, both the magnitude of utilization and the degree of variation decreased sharply (shown in the right panel, above).

Following the logic pattern used previously, **if the rate of hospital days in all ZIP codes in all counties had been the same as in those with household incomes greater than \$80,000, the total number of hospital days utilized throughout these counties would have been 33% less.**

The Impact of Low-Income ZIP Codes on Hospital Utilization

Decrease in the Utilization of Hospital Days if Utilization in All ZIP Codes were at Standard				
Utilization Standard	Ages			
	18-44	45-65	65+	All
Milwaukee minus Poverty Corridor	33.3%		13.1%	29.8%
Los Angeles @ ZIPs >\$100,000	41.8%	63.7%	23.2%	36.4%
Los Angeles @ ZIPs >\$80,000	30.5%	42.0%	22.8%	30.2%
San Framento @ ZIPs >\$80,000	33.3%	38.9%	15.4%	26.1%
California Counties @ ZIPs >80,000	31.8%	40.5%	21.9%	33.1%

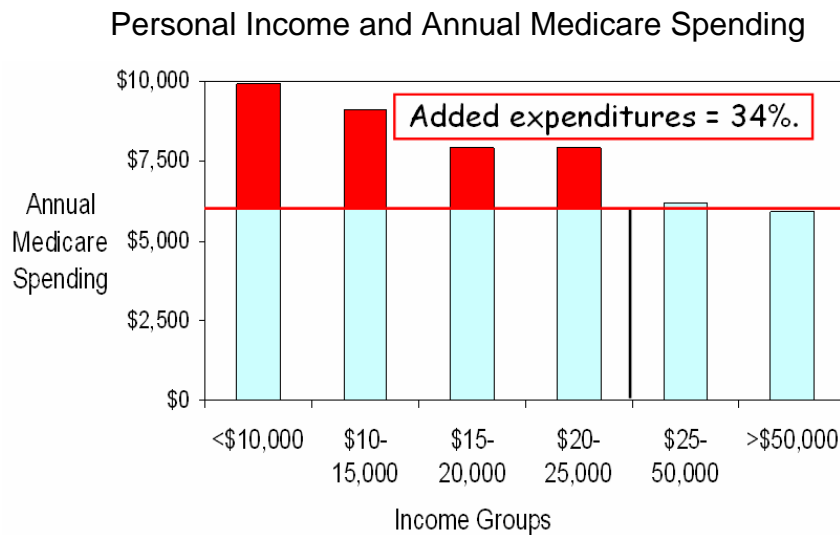
A recurrent theme throughout this series of observations is that hospital utilization is higher among individuals living in ZIP codes with lower median household incomes. It follows that if utilization could be the same everywhere as it is in ZIP codes with the highest income, total utilization would be less. Examples of this potential are cited throughout the narrative, and they are summarized in the table above.

In Milwaukee, the standard upon which “ideal” utilization was based was the rate of utilization outside of the poverty corridor. In Los Angeles, two standards were employed: ZIP codes with household incomes above \$100,000 and ZIPs above \$80,000, and this latter standard was applied to San-Framento and to the nine counties and county-clusters in California.

It is rather remarkable that, given the range of locales, the projected differences based on “ideal” utilization are so similar. Differences were largest among adults ages 45-64, somewhat less in younger adults and less in seniors. This smaller difference among seniors may reflect their higher utilization generally, but it may also reflect the fact that household income is not as valid a measure of wealth among seniors as it is among working families and that seniors who are ill find their way out of poverty cores. Few nursing homes are located in poor neighborhoods.

Considering all adult age groups, it seems reasonable to estimate that factors associated with poverty account for 30-35% of hospital days.

Two national studies reached a similar conclusion. First is an analysis of Medicare expenditures among beneficiaries of different income levels, illustrated below. Just as was observed with ZIP code income, there is a reciprocal relationship between personal income and annual Medicare expenditures, as illustrated below. When the number of beneficiaries at various income levels is considered, the fact emerges that, if expenditures on behalf of all beneficiaries were the same as the expenditures for beneficiaries in the highest income groups, total annual Medicare spending would be 34% less, a magnitude of difference that is consistent with the estimate above.



The second national study was conducted in Britain by Sir Michael Marmot and his associates and recently published in a report entitled “Fair Society, Healthy Lives ” (4). It concluded that one-third of the NHS budget is devoted to the added health care costs of income inequality. The following is a graphic from that report:

Fair Society, Healthy Lives

The Marmot Review

Direct NHS healthcare costs in England associated with treating the consequences of inequality amount to £5.5 billion per year for acute and mental illness.

These activities represent approximately one third of the NHS budget.

It is likely that the full impact of health inequalities on direct healthcare costs is considerably greater than this.



The consistent theme throughout these studies is that **the added health care associated with poverty accounts for about one-third of spending**, whether it is national Medicare spending, NHS spending or hospital days in urban communities in Wisconsin and California. This increased utilization varies geographically because poverty is geographic. **While some have attributed geographic variation to waste and inefficiency in clinical practice, particularly in urban centers, it is in fact a tragic consequence of poverty.**

WHY?

What is it about poverty that causes such marked increases in health care spending (5)? Is it simply being poor - an individual's lack of resources and the associated lack of adequate housing, food and access to necessary medications? Is it the lack of childhood education that is endemic in poor neighborhoods and is often the precursor to adult poverty, or the burden of childhood poverty and its associated accumulation of chronic illness and nutritional deficits, previously malnutrition and now obesity? Is it the crushing environment of poverty ghettos, with their drug problems, gangs and concern for personal safety? Or is it a lack of family support and social networks or the presence of racism? Or possibly poor access to public transportation and even poorer access to taxis or friends with cars?

Is it access to nutritious foods? Poverty ghettos are “food deserts,” areas with no grocery stores, a problem that Pennsylvania is beginning to address through subsidies to food markets. Or is it

difficulty with language? Many who are poor do not speak English or do so too poorly to communicate with the health care system, and there are too few interpreters or patient guides to go around. Or is it a lack of jobs, self-esteem and hope for the future, without which illness is simply a metaphor for life?

How much is due to the burden of mental illness, which is more prevalent among the poor and which is a secondary diagnosis in a high proportion of hospital readmissions? And how much is related to the health care system, with its crowded facilities and overworked staff who disproportionately care for the poor? Or a lack of access even to that, because of inadequate insurance and unavailable times for office visits?

There are numerous inefficiencies and inadequacies in the way health care is delivered and the way medicine is practiced, many fewer than existed three decades ago and, hopefully, many more than will exist three decades hence. They are not geographic. Geographic variation is a manifestation of poverty and its myriad tentacles. It is critical that this be addressed. **The US cannot and will not be able to afford the high health care costs of poverty. Recognizing the problem is the first step to solving it.**

References

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2. Cooper RA. Regional variation and the affluence-poverty nexus. *JAMA*. 2009;302:1113-1114.
3. Billings J, Anderson GM, Newman LS. Recent findings on preventable hospitalizations. *Health Affairs*. 15(3):239-249.
4. Marmot, M. Fair Society, Healthy Lives – The Marmot Report. Strategic Review of Health Inequalities in England post-2010. www.marmotreview.org.
5. Wilkinson R, Pickett K. *The Spirit Level – Why Greater Equality Makes Societies Stronger*. London. Bloomsbury Press, 2009

Appendix

Poverty in America

Large and Medium-sized Cities

With

Urban Poverty Zones

Atlanta

Boston

Chicago

Miami

New Brunswick

New Haven

New York

Philadelphia

Sacramento

St Louis

Tampa

Milwaukee

Los Angeles

Smaller and Medium-Sized Cities

without

Concentrated Poverty Zones

Danville PA

Grand Junction CO

Green Bay WI

Hanover NH

Iowa City IA

Rochester MN

Portland

Seattle

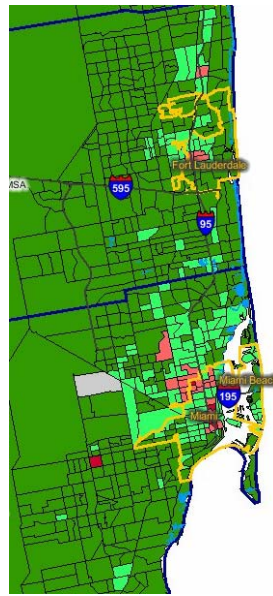
Adapted from The Bruton Center at the University of Texas at Dallas <http://urbanpoverty.net/>

Note: Low income tracks with universities, military bases and other institutions where residents have low incomes are excluded.

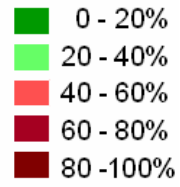
Chicago



Miami



% Poverty



Philadelphia



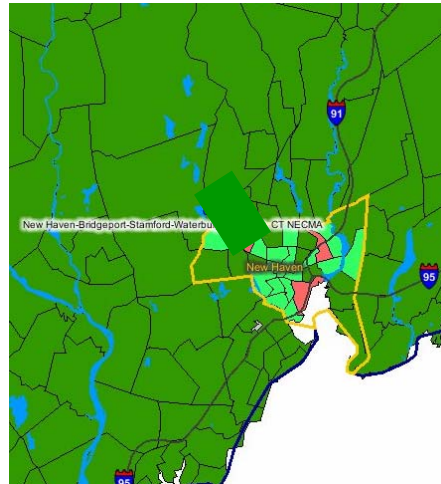
Atlanta



Boston



New Haven



Sacramento



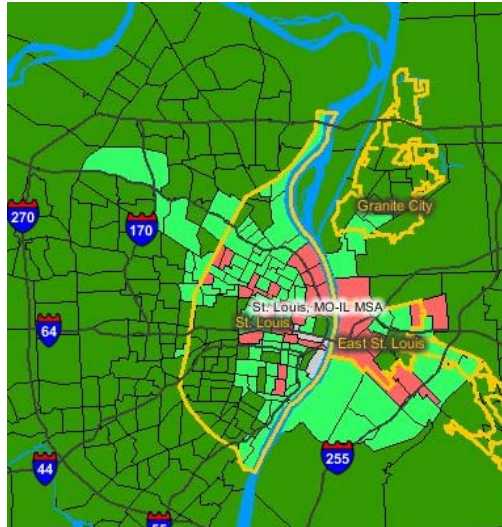
Tampa



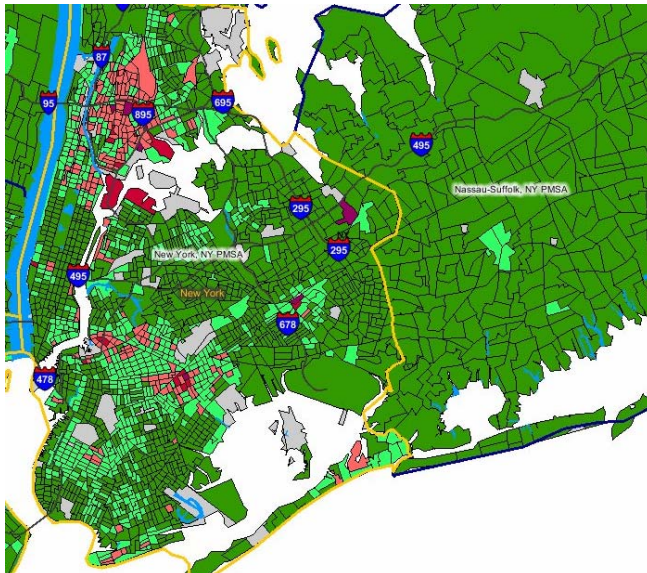
Newark - New Brunswick



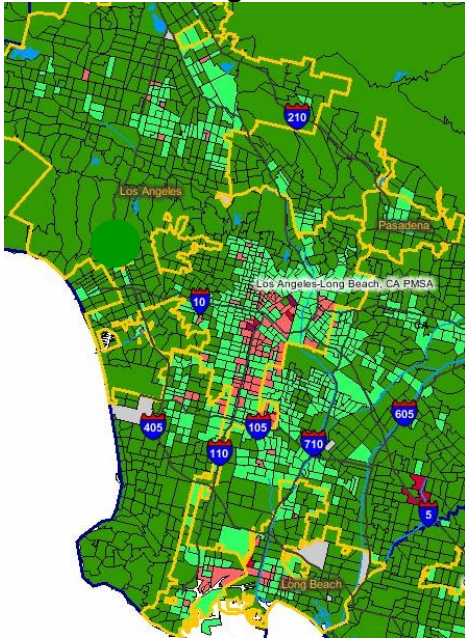
St Louis



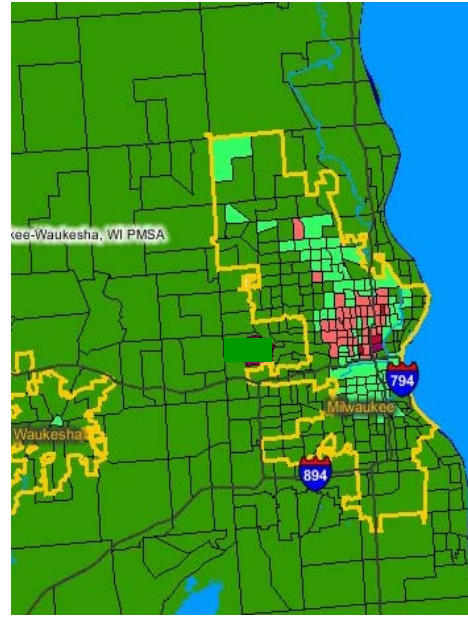
New York



Los Angeles



Milwaukee



Green Bay, WI



Rochester, MN (Mayo)



Grand Junction, CO (Intermountain)



Danville, PA (Geisinger)



Hanover, NH (Dartmouth)



Iowa City, IA



Seattle



Portland

