LOWN INSTITUTE
HOSPITALS INDEX
White Paper Series

Measures of Inclusivity at Hospitals in the United States

INTRODUCTION

Racial and economic health disparities are embedded in the fabric of American health care. For decades, we have known that racial and ethnic minorities experience a lower quality of health services and are less likely to receive even routine medical procedures than are white Americans.[1] They have less access to care, are less likely to receive treatment for chronic conditions, and are less likely to receive needed organ transplants.[2-4] Such disparities in care persist even when such factors as insurance status, income, age, comorbid conditions, and symptom expression are taken into account.

Not surprisingly, the health of Black and, to some extent, Hispanic Americans suffers as a result. Although racial disparities in life expectancy have narrowed since 2000, African Americans are still at greater risk of premature death and chronic illness; black individuals ages 18-49 are twice as likely as white individuals to die from heart disease, and black individuals ages 35-64 have double the risk for high blood pressure as white people.[5] The current Covid-19 pandemic has further shown racial and economic disparities in stark relief, as low-income and Black and Hispanic Americans have been disproportionately affected by the virus.[6]

These health care disparities trace their roots to two long-standing facts of American health care: the persistent de facto segregation of hospitals and other health care institutions and our fragmented health insurance system. Hospitals are required by law (EMTALA) to care for all who walk through their doors, but this only has legal force for emergency care and until the patient is stable enough to leave. And while Civil Rights legislation and the passage of the Medicare Act eliminated legal segregation in hospitals across the country, the legacy of Jim Crow laws in the South and the "Black

wards" and separate hospitals in the North left modern hospitals that serve primarily Black and other poor communities resolutely under-resourced and under-staffed. [7-9]

The situation is reinforced by the highly variable rates paid by different insurers. America's reliance on employment-based insurance leaves racial minorities disproportionately under- or uninsured. They are thus more likely than white people to be covered by a government program, such as Medicaid--which in many states pays significantly less than private insurance--and Medicare. All insurance payments, including those of Medicare and Medicaid as well as private companies, undervalue cognitive and preventive services while overvaluing procedures, some of which are of dubious clinical value.

Hospitals, forced by our system into the necessary pursuit of revenue, naturally have a tendency to seek paying customers with better insurance, particularly for lucrative elective procedures. Even when the increase in total revenue is only at the margin, the impact on the bottom line can be significant. They can find these well-paying patients in a variety of ways: building or buying up new "branches" in wealthy, often largely white, suburban neighborhoods where patients are likely to have well-paying insurance, for example.[10,11] Or by purchasing primary care practices in such neighborhoods in order to gain well-heeled patients through referrals.[12,13]

These fiscal realities and the historical pattern of hospital segregation have been recognized by health services researchers, but there is a paucity of tools for directly measuring the extent to which individual hospitals have overcome these twin forces in order to fulfill their social mission to treat all who need care. We developed a novel metric, called inclusivity, to describe the degree to which the proportions of different social classes and racial groups that a hospital serves matches those in its surrounding community. For each of three measures—income, education, and race—our inclusivity metric reflects the difference between the demographics of a hospital's actual patients' zip codes and the demographics of all the zip codes within the radius of the hospital's catchment area. We believe this metric provides a quantitative measure of the degree to which a hospital's patient population reflects the population that the hospital could be serving or should be serving.

METHODS

We defined a hospital's inclusivity as the comparison of the zip code demographics (of income, education level and race) of patients inside the hospital's four walls, relative to the population demographics of the hospital's catchment area, defined as the geography around the hospital from which its very own patients are drawn.

We determined the catchment area by using the zip codes of the hospital's own Medicare patient population, sorted them by the number of patients coming from each. We defined the radius of the catchment area as the distance to the zip code where the additional contribution of the next zip code to the total patient population became minimal. In this way all people living within the defined radius were deemed to be potential patients of that hospital. The median radius of our hospital catchment areas was 26.6 miles, with urban settings having far smaller radii than rural hospitals. The radius will vary, depending on the class of hospital (secondary, tertiary, or quaternary, as well as urban or rural location) but our method adjusted for that by using each hospital's own current patient population.

We estimated the demographics of each zip code by using census data on income, education, and race/ethnicity. We used the U.S. Census Bureau's American Community Survey data for people over the age of 65 and found the average income, education level and proportions of each race for each zip code. We then calculated the summary scores for the catchment area by including only zip codes within this area, and weighting these average and proportion values by 1) the over 65 population in the zip code and 2) the distance to the hospital. This second weight decreased the contribution of a zip code exponentially (5 percent per mile) beyond the point at which 50 percent of a hospital's patients had come.

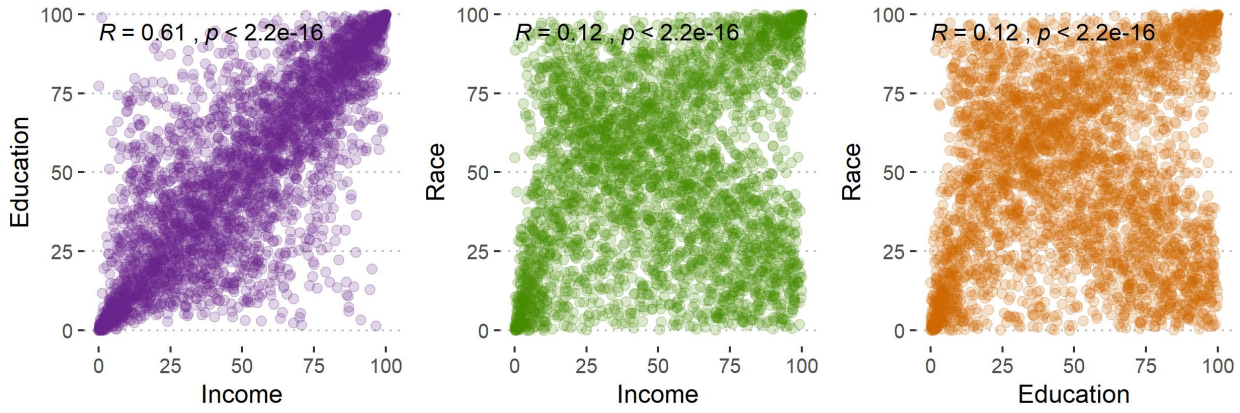
We created the patient scores by weighting the zip code averages/proportions by the actual patient counts from each zip code. We then compared the catchment area scores to the patient scores: a ratio for income and education levels, and a modified chi-square distance score summarizing the differences between the racial group populations. We averaged these three values (after rescaling to the same range) for the overall inclusivity score.

RESULTS

The inclusivity of U.S. hospitals varied considerably. For income the range was 0.69-1.86; for education, 0.79- 1.44 (both ratio scores); and for race, -37.64 - 18.20 (a difference score). Not surprisingly, safety net hospitals were more inclusive than others with an average percentile ranking of 59 percent for income, 58 for education, and 59 for race.

The scatter plots below show the comparisons of the final hospital percentile ranks of the inclusivity, education, and race metrics along with their rank correlation coefficient. Hospitals' income and education scores were highly rank correlated (R =

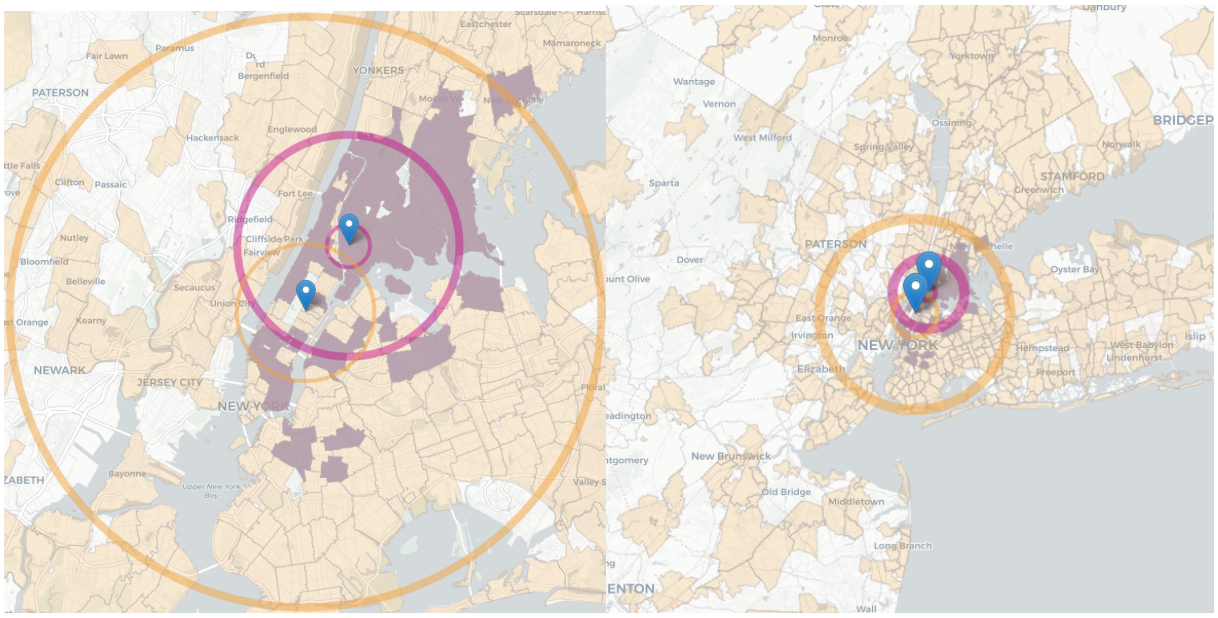
0.61), particularly at the highest and lowest scoring hospitals. The race metric was less correlated (R= 0.12 for income and education). We can see from the scatter plot, however, that many of the highest and lowest scoring hospitals on the race metric had similar results on the income and education metrics.



Values shown are the hospital percentile rank.
Also shown is the rank correlation coefficient for these percentiles.

CASE STUDY: INCLUSIVITY IN NEW YORK CITY

The maps below show the catchment areas and patient zip codes of two hospitals in New York City: Lenox Hill (orange; on the Upper East Side) and Lincoln Medical (purple; in the Bronx). The outer circle is the catchment area of each hospital. Lenox Hill has a larger catchment area as more of its patients came from farther away (and outside New York City, as the zoomed-out map of shaded zip codes below shows). The inner circle for each hospital is the radius within which 50 percent of the hospital's patients reside, and it is the distance from the hospital beyond which the catchment area demographic weights were steadily decreased. While there was significant overlap between the catchment areas of these two hospitals, Lenox Hill had one of the lowest inclusivity scores in our rankings while Lincoln Medical was the highest ranking hospital in the nation.



The circled catchment areas and zip codes with patients for two NYC hospitals: Lenox Hill (orange) on the Upper East Side, and Lincoln Medical (purple) in the Bronx. Left: the catchment area of each hospital is shown by the outer (thicker) circle, while the inner circle shows the distance within which 50% of the hospital's patients reside and after which the weights of the demographic contributions from those more distant zip codes are steadily decreased. Right: the map zoomed out to show the orange shaded zip codes representing a fuller picture of the footprint of Lenox Hill patients.

Lincoln Medical and Mental Health Center has a smaller catchment area than Lenox Hill, but the demographics within the two hospitals' catchment areas are similar. The expected patient income (based on the weighted average of income groups in each zip code) were $52,721.81 for Lenox Hill and $51,745.44 for Lincoln. The hospitals diverge when it comes to the income of their actual patients. The observed hospital patient income (estimated from the patients' zip codes) for Lenox Hill was $71,875.63, resulting in a ratio of 0.73 and a ranking for income at the 0.03 percentile. For Lincoln Medical, the observed hospital patient income was $27,802.34, resulting in a ratio of 1.86 and a ranking in the 100th percentile.

For education, the catchment area scores were also similar, 3.66 and 3.62 for Lenox Hill and Lincoln respectively, but the patient education scores were 4.60 and 2.53 respectively, resulting in a ratio of 0.79 for Lenox Hill and 1.43 for Lincoln. Note these values correspond to the different education levels in the census, for example: 2 = 9th to 12th grade education, high school education = 3 and some college, no degree = 4, 5 = associate's degree.

Within the catchment area, the weighted percentage of persons of color was 62.71 percent for Lincoln and 57.25 percent for Lenox Hill. For Lenox Hill, the estimated

percentage of persons of color based on the patient zip codes was comparatively smaller, at 31.53 percent. The biggest driver of this difference was in the Black population (21.66 percent in the catchment area versus 10.39 percent in the hospital patients) and the Hispanic population (23.83 percent in the catchment area versus 13.68 percent in the patient population). This translates into Lenox Hill's ranking landing in the 1.87 percentile for race inclusivity in the nation. Meanwhile, Lincoln had an estimated percentage of persons of color of 94.51 percent, again driven by results from the Black population differences (22.34 percent in the catchment area versus 32.33 percent in the hospital) and Hispanic population (36.37 percent versus 63.73 percent). Lincoln Medical ranked in the 99.88 percentile for race inclusivity in the nation.

INCLUSIVITY BY HOSPITAL TYPE

While inclusivity varied greatly between specific hospitals, variations between hospital types were more subtle. All of the average rankings by hospital type land within the middle third of rankings, which is not the case for other metrics on the Lown Index. However, there are a few notable differences (see Table below). On average, safety net hospitals and for-profit hospitals have higher rankings on all three measures of inclusivity compared to non-safety net and nonprofit hospitals. Critical access hospitals, non-urban and very small/small hospitals have higher rankings on the race score and lower rankings on education and income inclusivity relative to non-critical access, urban and larger hospitals.

The higher average scores of safety net hospitals makes sense because we have defined safety net hospitals as those serving a larger proportion of patients eligible for both Medicare and Medicaid. Dual-eligible patients are by definition lower-income and are also more likely to be people of color.

Table: Average inclusivity percentile rankings by hospital type*

Hospital type	# of hospitals	Inclusivity rank	Income inclusivity percentile	Race inclusivity percentile	Education inclusivity percentile
For-profit	543	1504	55	52	55
Nonprofit	2811	1715	49	50	49
Not urban	1234	1795	46	56	45
Urban	2120	1615	52	46	53
Not safety net	2670	1773	48	48	48
Safety net	692	1327	59	59	58
Critical Access	728	1826	44	57	44
Not critical access	2634	1641	52	48	52
Very small & small	1411	1757	47	52	48
Medium- Large- Very large	1943	1626	52	48	52

*All results are statistically significant ($p<0.01$)

Somewhat surprising is the finding that the average inclusivity rank of for-profit hospitals is somewhat higher than that of nonprofits. It is possible that, like safety net hospitals, many for-profits are located in communities where there are large numbers of racial minorities and people of lower than average socioeconomic status, and the hospitals are thus performing a public good in their provision of care. It is also possible that they are the health care version of profit-seeking businesses that operate in communities that are otherwise underserved and extract a substantial premium for doing so. Our data do not provide an answer.

These rankings reflect relative performance on these metrics across the nation; a ranking lower than the 50th percentile does not mean these hospitals' scores did not reflect their catchment area, just that the difference between their patients and their catchment area was smaller relative to other hospitals in the nation. Critical access hospitals and non-urban hospitals are more likely to be in areas with a predominantly white population in the catchment area. As mentioned in the limitations section below,

this meant that their race difference score had a positive bias -- the hospitals could only stay the same (that is, have patients equally within their catchment area and have a mid-range score of zero) or improve their patient diversity (have patients outside their catchment area resulting in a race score greater than zero).

Income and education, which were ratio scores, are close to one if the patient zip codes reflect the catchment area. Hospitals in rural areas may have less capacity to achieve a higher score (compared to hospitals in urban areas) if they have less variation in their populations' education and income levels. For example, the average education ratio for non-critical access hospitals was 1.02, while for critical access hospitals it was 1.01. Our future work will look at further unpacking the geographic and population diversity on the inclusivity metrics.

DISCUSSION

Our inclusivity metric represents the product of, and provides a window on, complex forces and long historical legacies--encompassing the sociology of rural areas, especially in the South, and of urban areas, particularly in the North after the Great Migration, and the more recent transformation of the low wage sector by globalization and immigration. We recognize that a hospital's inpatients' demographics are the result of many factors related to accidents of history and geography that have pinned an institution to one location rather than another. Thus, inclusivity is not entirely the result of decisions made by hospitals' leadership. More proximally, inclusivity is the result of the patchwork of insurance types and rates of payment, contemporary referral patterns, the cultivation of referring physicians by hospitals, and the cultures within hospitals. And many of these decisions are within the purview of hospital executives.

In other words, inclusivity to some extent is the result of hospitals' seeking well-insured patients through such business strategies as marketing, buying up desirable physician practices, the location of new facilities and the development of lines of service that would be profitable if the pipeline were filled with the "right" patient population—in short, all the commercial behavior that our system requires of hospitals to survive financially by capturing a particular slice of market share. Even a hospital's position on other rankings, notably U.S. News & World Report, serves as a marketing opportunity to attract the "right" kind of patient.

The broad correlation of our rankings across income, education and race are not a surprise. The fact that the race metric had a lower correlation than the other two suggests that race (or rather, the impact of racism) has an effect beyond being a simple surrogate for the effects of poverty or education level. Further supporting this point, it is important to note that these results are for Medicare patients only, therefore the

patterns we see do not reflect direct revenue seeking behavior by the hospital in the immediate-term, since Medicare payment rates are identical regardless of the beneficiary's race and class. It is more likely a combination of historic legacies, patient behavior from within communities, as well as leakage from marketing strategies targeting commercial patient populations, though this last observation is admittedly speculative.

LIMITATIONS

Our method is based on zip code areas and assumes that people within a zip code all behave similarly and are equally likely (regardless of income level, education level, or race) to visit one hospital within a catchment area. Using this method, we do not know the actual income, education or race of the hospital patients— these are all inferred based on the patients' zip codes. If, for example, a zip code had an 80 percent population of low-income earners and 20 percent of high-income earners, we assume that the hospital's income amount from this zip code would be as if all persons from the zip code were equally likely to go to the hospital. If, in fact, all of the patients coming from this zip code were high-income earners (that is, only the 20 percent went to the hospital while the low-income earners went elsewhere) then we would have given the hospital a better income score than if we had actual patient income data. This limitation may reduce the accuracy of our estimates. However, when we compared this method to one using an actual patient level social identifier that is available in the claims data (race), we found a high correlation (0.83) between the hospital scores calculated using zip code demographics and hospital scores calculated using patient claims data.

Our catchment area is also defined as a circle with a radius, where a zip code either falls in or out of this boundary based on the central point of the zip code. Direct distance may not always reflect the true travel distance or travel time for potential beneficiaries. Our method treats all beneficiaries within the catchment area at equal direct distances the same, even though the travel times (and therefore likelihood to go to the hospital) may be different.

Our inclusivity scores, by design, reward hospitals that over-serve communities with lower average income, education attainment, and higher minority populations. Hospitals that have similar patient and catchment area zip code demographics receive a mid-range score in the percentile ranking of the inclusivity scores. Some of these hospitals, however, may be in a situation where it is difficult to improve on this score (for example, a hospital may be in a catchment area that is all very wealthy and their beneficiaries reflect this demographic).

We apply the same method across all hospitals within the US, treating urban and non-urban (and acute and critical access hospitals) the same. Population distributions vary widely across the US, and thus hospitals serve populations with different demographics depending in large measure on where they are located. The simple fact of location is reflected in our results. For example, hospitals that have a catchment area with a majority white population (which are mostly critical access hospitals or rural hospitals) will be less likely to get penalised on the race score than hospitals in urban, more diverse areas. A theoretical hospital may have a catchment area that is 100 percent white based on the census data. If their patient population matches this (it is also 100 percent white), then it will get a race difference score of zero and be in the middle of the hospital race rankings. If the hospital has some patients from zip codes outside its catchment area that do not all have a 100 percent white population, then the hospital's race score will be positive and it will get a higher ranking. Hospitals in predominantly white areas (that is, close to 100 percent) will therefore have higher race scores on average relative to hospitals serving disproportionately white patients in more diverse communities. While this inclusivity score technically gives an 'advantage' to hospitals in homogenous areas, it is by design: we clearly did not want to penalise hospitals for having similar patient demographics as their catchment area.

Hospitals in predominantly white communities still vary in their results for education and income. For example, Osceola community hospital in Iowa had a 100 percent white population within its catchment area, and its patients' zip code demographics varied. This resulted in a ranking in the 90.2 percentile of hospitals on race inclusivity, a ranking in the 24.3 percentile for education, and an income ranking in the 44.9 percentile.

The average score across all hospitals for income was 1.034; for education it was 1.021. In other words, there was higher hospital utilization overall from less wealthy/educated areas, perhaps due to the fact that poorer communities offer less access to outpatient care and preventative health compared to wealthier communities.[14,15] This is not an unexpected finding, but it needs to be remembered when interpreting the percentile ranks of hospital performance; hospitals may have a percentile rank lower than 50 percent (that is, have a worse score than 50 percent of hospitals in our ranking), but their income/education ratio may still be above 1.0. For income, 31.5 percent of hospitals had a ratio below 1.0, and for education 32.5 percent had a ratio score below 1.0.

CONCLUSIONS

American hospitals vary widely in their inclusivity. Some hospitals cater to wealthier, better insured white patients while others care for people of color, lower economic circumstances, and lower education levels. This much has been known for many years, although the Covid-19 pandemic has brought the differences among hospital populations into sharper focus than ever.

Our inclusivity metric provides a way of measuring these observations by showing the degree to which differences among hospital populations has simply to do with geography and the demographics of a hospital's surrounding communities. And unlike previous observations of racial and economic differences among hospital populations, our metric is hospital specific, making it possible to compare hospitals directly. This will allow hospital leaders, policy makers and journalists to track trends of inclusivity over time to assess how well the American health care system is overcoming structural barriers of race and class. In the future, we plan to incorporate this metric of social mission in relation to other dimensions of hospital performance.

ABOUT THIS WHITE PAPER

This white paper is part of a series analyzing specific metrics in the Lown Institute Hospitals Index. This paper was written by Vikas Saini, Kelsey Chalmers, Shannon Brownlee, and Judith Garber. Valérie Gopinath, Paula Smith, Kelsey Chalmers and Vikas Saini led the data analytics for this project.

Suggested Citation: Saini, V., Chalmers, K., Brownlee, S., Garber, J. Measures of Inclusivity at Hospitals in the United States. Brookline, MA: The Lown Institute. 2020.

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