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Have public hospitals outlived their usefulness? Is it possible to assess with health care parameters the impact of public hospitals on major American cities?

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ABSTRACT

Background: Short-term acute care public county hospitals in the US were a mainstay of much "safety net" medical care in the early twentieth century. The private sector currently provides much of what was in the past public medical care. Does this transition affect health care indices?

Methods: The presence of public hospitals was determined for the 50 largest metropolitan areas using the American Hospital Directory databases. Health care indices assessed included birth rate, death rate, infant mortality, the American Fitness Index, and a derived Composite Health Index. Co-variables included size of population and geographic location. Data were compiled in 2017, using databases between 2006 and 2017.

Results: Over half (56%) the largest fifty metropolitan areas in the US still have acute care public hospitals, less often in the East. Birth rates were higher (Kruskal-Wallis, P = 0.02) and death rates lower (KW, P = 0.03) in metropolitan areas with such public hospitals, infant mortality (P = 0.09), the AFI (P = 0.73) and the Composite Health Index (P = 0.64) did not differ by their presence. With a multivariable analysis, geographic area most affected the Composite Health Index.

Conclusion: By this model, health care indices do not differ by the presence of an acute care, publically funded and administered governmental hospital and the future of acute-care public hospitals in their traditional format is in doubt.

Introduction and background

Does the presence of a public hospital affect the level of medical care in an urban American area? It were often stated after the closure of Philadelphia General Hospital in 1977 [1] that public hospitals are needed to maintain the standards of health in a community by the role of such facilities in treating the poorest of the citizenry. The presence of abundant federal and state resources in most jurisdictions first through Medicare and Medicaid [2] and later through the Affordable Care Act [3] often means that the indigent are provided now with multiple points of access to the medical care system and that a large publically financed hospital or set of hospitals is no longer as necessary as it might have been earlier in American history.

The number of variables affecting health care outcome are great, the number of jurisdictions meriting study large, and the definition of hospital facilities all make such a study cumbersome and at times confusing. In order to assess the thesis question {"Does the presence of a public hospital affect health care outcomes?"), a set of arbitrary definitions and measures were established as listed in the Methods section. The geographic areas considered showed considerable impact on outcome and were again defined as listed in the Methods section.

The paucity of articles attempting such a study testifies to the difficulties inherent in such a study. Nonetheless, the results provided enable one to embark on a further discussion about the continued usefulness of public administered and funded, acute care hospitals in American society.

Methods

The fifty largest metropolitan areas (as defined by the US Bureau of the Census) were identified. The presence of locally or state run acute care hospitals were identified using the computerized databases by the American Hospital Directory [4,5]. Health care indices were identified for each area using published data on birth rates [6], death rates and infant mortalities [7,8], and a fitness index (compiled by the American College of Sports Medicine and identified as the American Fitness Index) [9]. A Composite Health Index was identified using these four variables (giving arbitrarily equal value to each, inverting those [death

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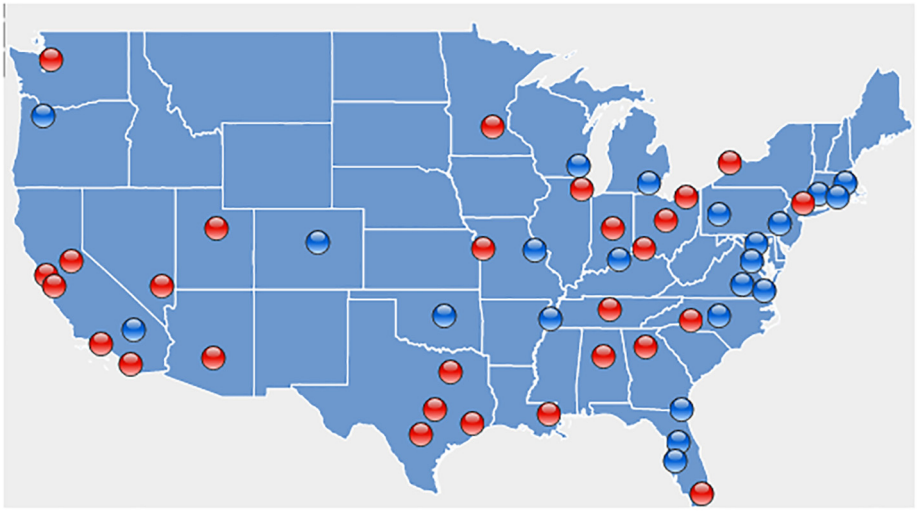

Fig. 1. Fifty largest metropolitan areas, with (red) and without (blue) acute care public hospital. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

rate and infant mortality] where higher values are less salutary, and scaling all four variables to a common factor before adding the sum). Regression analyses using Stata 11 [10] were performed using as independent variable the presence of a public hospital, population size, and geographic location (as stratified by the US Bureau of the Census [11]. The latter included an additional (besides East, mid-West, South, and West) area, the Southwest which consists of areas of the South and West (for this analysis including the major metropolitan areas of Arizona, Louisiana, Nevada, Oklahoma, and Texas).

Mortality indices were best available in a complete fashion for 2006, population for 2010, and AFI for 2015. The specific data used are available in Supplementary Table 1. The controversies attendant with the use of different timeframes are discussed below.

The American Fitness Index is a combined score that includes health behaviors (percentages exercising in the last 30 days, meeting aerobic activity guidelines, meeting aerobic and strength activity guidelines, consuming two or more fruits a day, consuming three or more vegetables a day, sleeping 7 or more hours/night, and smoking), health outcomes (percentages with obesity, in good or excellent health, in poor physical health the last 30 days, in poor mental health the last 30 days, with asthma, with hypertension, with diabetes, with coronary disease, and with stroke), community outcomes (percentage of parkland, acres of parkland, numbers of farmers' markets, percentage using public transportation to work, percentage bicycling to work, a Walk score value, and percentage within a ten minute walk to a park), prevalence of recreational facilities (ball diamonds, dog parks, park playgrounds, basketball hoops, park units, recreational centers, swimming pools, and tennis courts), and public policy parameters (park expenditures per resident and physical education requirements), with the highest values among the 50 metropolitan areas of this study being in Arlington VA (DC area) at 77.7 the lowest Oklahoma City at 26.3.

Results

The fifty metropolitan areas studied ranged in size from New York (population, 20.1 million) to Buffalo (1.3 million). They included seven areas in the East (Boston, Providence, Hartford, NYC, Philadelphia, Baltimore, Washington), twelve in the mid-West (Pittsburgh, Cleveland, Columbus, Cincinnati, Indianapolis, Detroit, Chicago, Milwaukee, Minneapolis, St Louis, Kansas City, Buffalo [controversially part of the mid-West]), fourteen in the South (Richmond, Virginia Beach, Raleigh, Charlotte, Atlanta, Miami, Orlando, Tampa, Jacksonville, Birmingham, New Orleans, Louisville, Nashville, Memphis), eight in the Southwest (Houston, Austin, Dallas, San Antonio, Oklahoma City, Denver, Phoenix, Salt Lake City), and nine in the West (San Diego, Los Angeles, Riverside, Sacramento, San Jose, San Francisco, Las Vegas, Portland, Seattle).

Short-term acute care governmental hospitals were present in 28 of the 50 geographic areas (see map, Fig. 1). Such facilities were uncommon in the East but found in the majority of Western, Midwestern, and Southwestern metropolitan areas. The Composite Health Index (CHI) by metropolitan area is listed in Table 1 (data on component analysis are available from the author). Table 2 shows a ranking of metropolitan areas by population and by the Composite Health Index, with no consistent pattern between areas with locally funded public health hospitals (red arrows) and without such hospitals (blue arrows). The regression variables and analysis are provided in Table 3. In this model only did geographic area show a significance in the regression analysis.

The variables used to make up the CHI showed differences by geographic area and by population size. Death rate correlated with the geographic area (lowest in the West, $P = 0.05$) and in smaller cities ($P = 0.01$) while birth rate correlated with region of the country (lowest in the East and Midwest, $P = 0.001$), AFI with region of country (highest in the West, $P = 0.002$) and in smaller cities ($P = 0.01$). The CHI was highest for San Diego and lowest for Memphis and in general the CHI was higher in smaller cities ($P = -0.01$) and by trend in the East, Southwest, and West ($P = 0.07$). By a Kruskal-Wallis measure of correlation, the CHI also differed by geographic areas, with the highest average values in the West and the lowest in the South ($P = 0.0003$, KW). Size had no correlation by geographic areas, using the KW test ($P = 0.13$).

The presence of a publically funded and administered short-term, acute care facility correlated poorly and inversely with birth rates (correlation coefficient, Pearson, -0.33) and moderately with the death rates (0.29) or infant mortality (0.25), but did not correlate with the American Fitness Index (0.04) or the Composite Health Index (-0.08).

Discussion

The demise of a public hospital, as Philadelphia experienced in 1977, was once considered a direct insult to the care for the indigent in an urban area. With the increasing availability of public funds through mostly federal, but also state and local, governmental agencies, it is now likely that the poor can be cared for at private facilities formerly unavailable to them. Nonetheless, it is worth asking whether the presence of major public facilities shows an impact on health care indices.

Table 1
Composite Health Index, from high to low, by leading city of fifty largest U.S. metropolitan areas.

Metropolitan Area	Composite Health Index
Washington	28.93
San Diego	28.46
Minneapolis	28.23
San Jose	27.32
Denver	27.14
Sacramento	26.64
Seattle	26.28
Portland	26.26
Salt Lake City	26.18
San Francisco	25.71
Boston	25.17
Raleigh	24.47
Austin	23.96
Atlanta	23.58
Hartford	23.12
Los Angeles	22.50
Chicago	22.16
Virginia Beach	21.92
Richmond	21.33
Cincinnati	21.28
New York	21.21
Baltimore	20.64
Las Vegas	20.58
Kansas City	20.46
Riverside	20.46
Philadelphia	20.06
Houston	19.71
Providence	19.47
Miami	19.45
Phoenix	19.42
Pittsburgh	19.32
St. Louis	19.22
Cleveland	19.10
Tampa	19.07
Dallas	19.05
Milwaukee	18.95
Orlando	18.53
Jacksonville	18.42
Columbus	18.22
Buffalo	17.89
Charlotte	17.72
San Antonio	16.87
Detroit	16.73
New Orleans	16.43
Nashville	16.16
Louisville	15.39
Birmingham	15.26
Oklahoma City	15.14
Indianapolis	14.64
Memphis	14.16

The health care indices chosen in this review were both primary (birth rate, death rate, infant mortality) and multifactorial (a multiterm analysis produced by the American College of Sports Medicine, entitled the American Fitness Index). The data in this study show that the composite health measure is not affected by the presence of a major public hospital, but is affected by geography and to a lesser degree by the size of the urban area.

This study is limited to major American urban areas. Rural health is a completely different issue and the great disparities between rural and urban health are discussed elsewhere [12,13]. In addition the urban communities of territories (Guam, Puerto Rico) are not analyzable because analyses usually are unfortunately limited to the fifty states.

The limitations of this study include at least three. First, the presence of public hospitals reflects care in the areas they serve, and for major urban areas such as Los Angeles, the presence of public facilities reflects the care to only a small portion of the population and one would expect the indices to be based on a population served by a larger portion of the population. Second, public hospitals are found preferentially in the West and South. The Northeastern metropolitan areas in particular have adopted a system of care whereby many private and religious institutions take over the care of the indigent (with public systems available in this series only in the New York metropolitan area). Under such diverse circumstances, it is difficult to assess the effect of the presence or absence of public hospitals. Finally, it is hard to obtain data for all variables for a given time (the AFI now reports for largest cities rather than metropolitan areas), so that using data now from several years ago may not reflect the actual state of health as the demographics change in cities.

Nonetheless, this study is an attempt to address an issue seldom analyzed quantitatively in the literature, that is, what is the correlation between the presence of a publicly funded hospital and the measures of health for that community. The answer it seems is that very limited correlation exists between the presence of such public, acute care facilities and variables based on vital statistics, variables that are influenced heavily for example by geography. The regression analysis confirms this finding with in the end only geography and population size being the variables associated with a metropolitan area having an acute-care publicly funded hospital. These data suggest that the traditional public hospitals are no longer needed the way they once were, and that they may need to find a new mission to serve communities that remain underserved (the undocumented, the imprisoned, and the mentally impaired).

The fact that the regression model explained only a minority of the outcome (CHI) is because many variables determine health, from smoking patterns to the quality of the environment, to eating patterns. In this limited model, the surrogate of geography best represents these variables. The major role geography encompasses in the determination of health was shown in a study in which the Mississippi River and Ohio River Valley states were shown to be the areas in which health care parameters show the least salutary outcomes [14]. The variables used in the latter model were based on data at the state level, data which are often more readily accessible.

In conclusion, these data suggest that public hospitals have outlived their usefulness. The described analysis shows a weak association between an internally derived CHI and the presence of a locally funded public health hospital. Using a regression analysis, however, the association disappears when one considers the impact of geographic area, with cities outside the South, in particular in the West and the Midwest, showing on composite measures of health. As cities enlarge and as medical care is diversified at all acute care hospitals including those in the private sphere, it is likely that publicly, managed acute care hospitals are a waning entity and that the future of medical care is found in a diversity of institutions that delegate some of their care to the underserved.

The traditional acute care public hospitals thus need to find new, innovative missions to serve those in most need, and this will differ by community. Such needs should be based on relationships with prisons and their inmate populations, the presence, types, and number of undocumented populations in the community served, and the number of homeless in the community. Also significant are political factors such as the relationship of the state and local communities to federal funding (for example, does the limited expansion of the Affordable Care Act (ACA) in some states affect the need for such hospitals), and the adequacy and funding of local mental health institutions. The number of variables to study is thus extensive and analyses need be based on data with sufficient sample size and from sources where there exists a uniformity of databases for the studied populations and geographic areas. This study looked only at major metropolitan areas and acute-care public hospitals. Many variables affect medical care including perhaps the presence of private vs public facilities, the presence of faith-based institutions, the expansion of the Affordable Care Act and its now tentative future, the presence of large immigrant populations, and mergers of health care facilities. The ability of future studies to analyze such multi-faceted variables will require the generation of databases

Table 2
Metropolitan areas ranked by population and by Composite Health Index with arrows in red for areas with short-term, acute care, locally funded public hospitals and blue for those without.

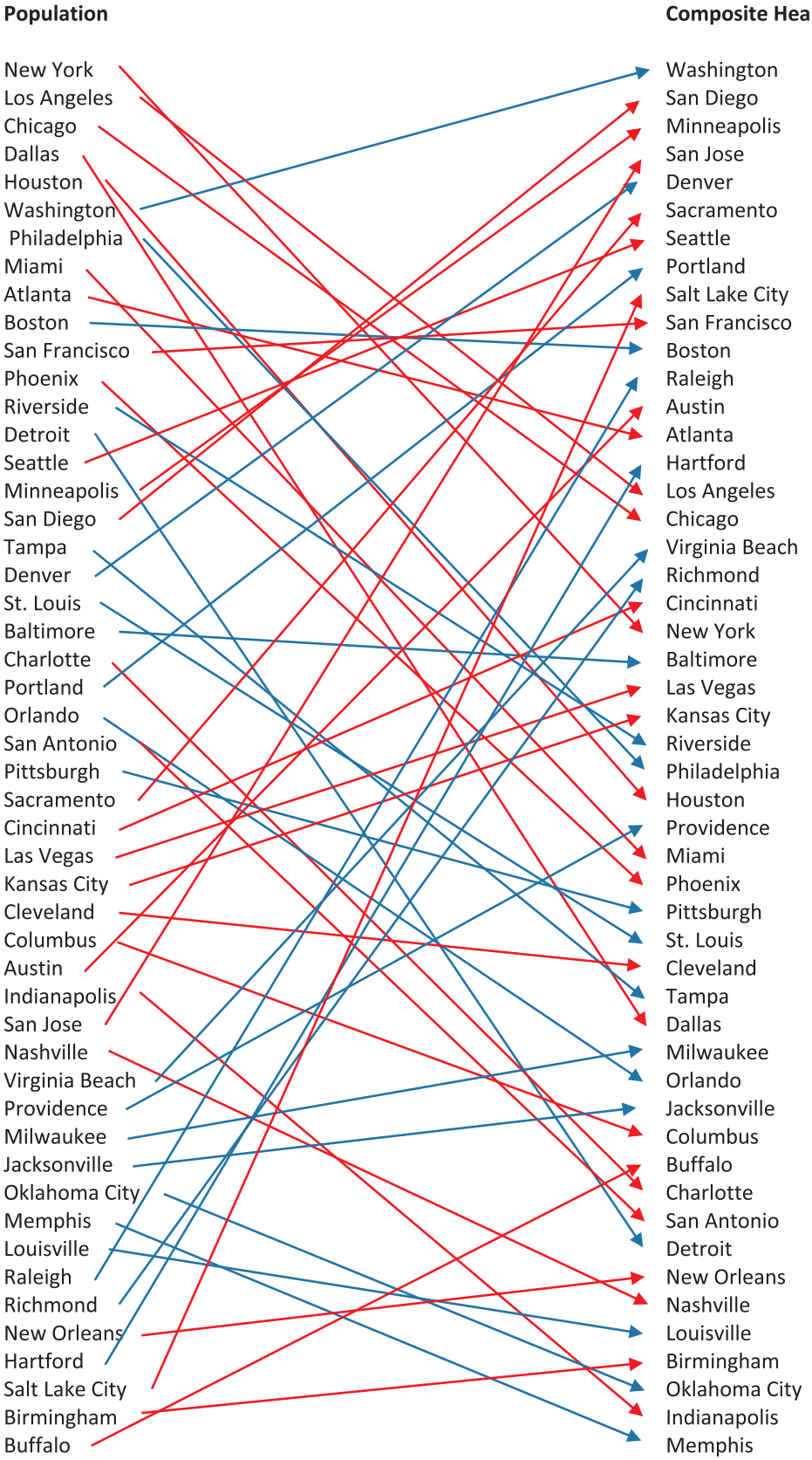

Table 3
Regression analysis of Composite Health Index against the presence of an acute care, locally funded public hospital, population size, and geographic areas (dividing US Census Bureau South into South and Southwest).

Source	Sum of squares	Degrees of freedom	Mean square
Model	92.13	3	30.71
Residual	684.92	46	15.86

Number of observations	50
F (3, 46)	2.06
Probability > F	0.12
R-squared	0.12
Adjusted R squared	0.06
Root mean square error	3.86

Composite health outcome	Coefficient	Standard error	t	P > |t|	[95% confidence interval]
Public acute care hospital	0.51	1.19	0.42	0.67	−1.89 to 2.91
Population size	2.36×10^{-7}	1.7×10^{-7}	1.39	0.17	-1.06×10^{-7} to 5.78×10^{-7}
Geographic Areas of US	0.96	0.44	2.19	0.03	0.08–1.84

including census material that reflects the total population and current health care indices.

Declaration of Competing Interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.mehy.2019.109265.

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