Obesity and place: Chronic disease in the 500 largest U.S. cities

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ABSTRACT

Objectives: Extant research clearly points to a correlation between place and health, specifically as it pertains to chronic diseases like obesity. The present study examines this relationship among a diverse set of compositional place indicators and obesity rates across census tracts in the 500 largest cities in the United States.

Methods: Using data compiled from the Robert Wood Johnson Foundation 500 Cities project and the Census' American Community Survey, the analyses examined aggregate relationships between sociodemographic, socioeconomic, and housing characteristics of census tracts and crude prevalence obesity rates in over 27,000 census tracts located in the 500 largest cities in the United States.

Results: Multivariate analysis confirms the place-chronic health connection. Regardless of variable groups, deteriorating places with higher concentrations of low-income, minority populations reported more obesity prevalence.

Conclusions: Place matters. The continuing burden of zip code in the United States for disenfranchised populations will likely continue to force policymakers to examine the role that place-based prevention and place-focused medical care plays in the future health and well-being of U.S. residents.

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Introduction

Obesity is a costly, persistent, and serious public health issue that continues to burden the U.S. health system. Nearly 70% of the U.S. adult population is considered either overweight or obese; twice and in some cases, three times more than any other chronic disease prevalence (e.g. hypertension, cancer, mental illness) among adults in the U.S [1,2]. Like other chronic diseases in the United States, obesity tends to follow patterns related to characteristics of the places where people reside and is not randomly distributed across communities [3–5]. Overweight and/or obesity in populations tends to be concentrated in high-risk communities, where residents have limited access to healthy foods, limited open/green space, a lack of quality and accessible health care, and are often residing in physically, socially, economically, and emotionally isolated, unhealthy "deserts" throughout large metropolitan areas in the United States [6–8]. This "ecology of disadvantage" has clear health implications for the populations that live in these unhealthy places where risks to experience considerable physical and mental health problems across the life course are elevated compared to persons living in healthier communities [9–12].

While place typically has been an important construct in the health conversation, both in the United States and around the world, what has been lacking has been comprehensive, place-specific chronic disease data collected at the micro level (i.e. census block, tract). Most of the health and place conversations have been limited to examining health risks in the context of larger geographic units (i.e. country, state, Metropolitan Statistical Area, county) [3,13,14]. In addition, there has been limited work examining chronic disease in micro-level units across the country; typically, analyses are limited to a small number of states or a single region of the country.

In an effort to address these methodological shortcomings, we present a comprehensive examination of the compositional "correlates" of census tracts with crude prevalence rates of obesity in the United States' 500 largest cities [15]. These 500 largest cities are dispersed throughout the United States with at least one city in every one of the 50 states and obesity prevalence estimates constructed for nearly 30,000 census tracts. As such, the intent of the study

is to examine patterns of weight status dispersion across these 500 cities while asking the question: What compositional community characteristics are correlated with crude prevalence obesity rates at the census tract level? The pattern should be clear. Census tracts in older, more deteriorated cities would be expected to have higher rates of prevalence of chronic disease; in particular, being overweight and/or obese.

We focus on chronic health issues in urban centres for several reasons. First, the majority of the U.S. population is concentrated in urbanised cores with over three-quarters of the current population living in the central core and suburban rings of metropolitan areas [16]. Second, expanding urbanisation has had dramatic effects on the environment—increasing air, water, and noise pollution, consumption of non-renewable resources, limited green space for sustainable agriculture, exercise/recreation, etc. With these growing planetary health risks, we have witnessed important effects on urban residents who are exposed at significantly higher levels of physical/mental risk compared to residents living in other locations across the metropolitan area [9,12,17]. Finally, because the city is an "artificial" constructed space, it can be designed/changed in ways to improve health on a large scale. Obviously, there are considerable health costs to living in urban areas—these costs tend to be highest among persons living in the urban core where the circumstance of poverty and racial/ethnic status are exacerbated by segregation and racial discrimination. The intersection of poor nutrition/eating habits, poverty, unemployment, deteriorating housing, and limited resources has deepened the divide between the haves and have nots and created a health crisis that is clearly detectable based on where people live.

Methods

We conducted a cross-sectional analysis by using two secondary sources: data from the 2015 Behavioral Risk Factor Surveillance System (BRFSS), as part of the 500 Cities Project, and the 2015 American Community Survey [17]. Overall, we compiled/merged data from over 27,000 census tracts that were located in the 500 largest cities in the United States; seven hundred and ninety-four census tracts (2.8%) were removed from the analysis because fewer than fifty residents resided in the census tracts and the prevalence rate was redacted [15]. The project provides data on 497 of the largest American cities and includes data on Burlington, Vermont, Charleston, West Virginia, and Cheyenne, Wyoming to ensure the inclusion of cities from all 50 states. The city population size ranged from 42,417 in Burlington, Vermont to 8,175,133 in New York City, New York. The census tracts range in population with less than 50 (removed from the current analysis) to 28,960 persons. The estimated population includes more than one-third of the total U.S. population in 2010 (103,020,808). The 500 cities were selected based on 2010 population counts with data including places within each state and their respective cities, towns, villages and boroughs.

To utilise demographic information archived in the census tract files for data analysis using the 500 cities data, data pre-processing needed to be conducted. In general, the census tract data were used to clip the boundaries of the cities. As a result, each city represented in the 500 cities project potentially contained multiple segments. In some cases, a section of a city could not use the demographic information of the corresponding census tract directly. In the 500 cities project, each section of the city had an estimated value of total population (Pop$_{city}$), and each census tract had information on the total population (Pop$_{tract}$). A ratio was derived as $R = \text{Pop}_{city}/\text{Pop}_{tract}$ where the data in the 500 cities project were joined with census tract data using the same census tract identifier. When the demographic information of the census tract (e.g. population number by age, race, gender, etc.) was used to conduct analysis on the city data of the 500 cities project, this ratio was applied. When the socioeconomic data of American Community Survey (e.g. household income, poverty rate, etc.) was joined to the city data, this ratio was not applied. This conjoined data represents our initial attempt at examining the co-variation of crude prevalence obesity rates with population and community compositional characteristics across census tracts.

Measurement

The primary objective of this study was to examine obesity prevalence rates across relatively small geographic units in the 500 largest cities in the United States. As such, we examined obesity prevalence as estimated by the 2015 BRFSS among non-institutionalised adults 18 years of age and older. The BRFSS was established in 1984 and is sponsored by the Center for Disease Control and Prevention (CDC). The surveys are administered over both land-line and cellular phones to collect geo-coded data from U.S. residents in all 50 states as well as the District of Columbia and three U.S. territories regarding health risks behaviours, chronic health conditions, and use of preventive services. The target for BRFSS is to typically collect 4000 interviews per state each year.

Independent variables representing the compositional correlates for the analysis were all obtained from the American Community Survey and other Bureau of Census Population Files [16,18]. The analysis consisted of examining a set of variables that included census tract level population demographics, housing, and socioeconomic characteristics. Specifically, we included the following demographic variables in the analysis: percentage of Blacks, percentage of Hispanics, median age of residents, and percent married. In addition, we included the following housing variables in the analysis: median home value of owner-occupied units and the median year that structures were built. Finally, we included socioeconomic variables in the analysis: the Gini index of income inequality [19] and the percentage of residents 25 years of age and over with less than high school education. The multivariate analysis used SPSSPC 23 and focused on both the impact of variable groupings and the statistical significance (95% CI) of individual unstandardised regression coefficients.

Results

Fig. 1 presents crude prevalence obesity rates across the 500 largest cities in the United States; average obesity rate in 2015 was 29.8. Clearly, the Eastern and Western parts of the country appear to be very different and we know this to be, in part, a function of both age of place and the predominant concentration of low-income minority populations. Nevertheless, there are some interesting exceptions to that rule. Despite the fact that there are significant concentrations of obesity in Florida, California, New York, and Texas cities, there are a number of cities in those states that, on average, report normal weight; southern California cities appear to report the greatest concentration of normal weight locations. Additionally, the greatest concentrations appear to be on the southern coastal areas of Texas, Louisiana, and Alabama, the eastern coastal regions of New York, New Jersey, and Massachusetts, as well as the Great Lakes region around Wisconsin, Illinois, and Michigan.

Table 1 presents the means and standard deviations for the variables included in the analysis. On average, these 500 city's residents had a median age of 35. Roughly 20% African-American and 20% Hispanics characterised the racial and ethnic composition of these cities, with 37% married among the population 15 years of age and over. On average, housing units were constructed in the median year 1966, with an average home value of $255,000. The Gini index