



Obesity and Religious Composition

Understanding Obesity Rates in Major U.S. Cities

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Abstract

As the obesity epidemic continues to grow in the United States, causing premature death and increased healthcare costs, researchers are investigating the various factors which contribute to obesity. Building on the developed literature connecting religious participation (defined as weekly attendance at church services) to physical and mental health outcomes, this study seeks to connect religious participation and the growing rates of obesity in the United States. Drawing on Centers for Disease Control and Prevention data of obesity rates in major metro areas and data on the religious composition (defined as religious identity, often self-reported [e.g., Catholic, Protestant, Muslim, Jewish]) of cities by the Public Religion Research Institute, this study looks at the relationships between religious composition and obesity rates.

Keywords: obesity, United States, religious participation, health outcomes, religious composition

Introduction

Obesity is a significant public health issue, on pace to soon become the leading cause of preventable deaths in the United States (Armour Forse, Betancourt-Garcia, and Kisse). By 2030, it is predicted that more than 85% of adults will be overweight or obese (Hruby and Hu). With obesity comes numerous adverse health effects, including increased risk of heart disease, diabetes, hypertension, osteoarthritis, and cancer (Blucher). Grover et al. showed lost years of life to be 8.4 years for very obese men aged 20-39 years and 6.1 years for very obese women aged 20-39 years. Obese individuals also report lower health-related quality of life as compared to those with normal weight (Pimenta, Bertrand, and Landeira-Fernandez) including negative effects on mental health due to stigmas of obesity (Tomiyama et al.). Additionally, the rate of childhood obesity has

more than tripled since the 1970s (Fryar, Carroll, and Ogden). Obesity in childhood carries its consequences into adulthood with the persistence of obesity leading to adverse health effects in adulthood (Campbell, Franks, and Joseph).

There are *numerous* known risk factors for obesity but precisely how they interact to cause obesity is still uncertain (Hruby and Hu). The risk factors include individual behaviors such as diet and exercise, as well as genetic, environmental, psychological, and socioeconomic factors (Lopez-Suarez).

The consumption of nutrient-poor, high-calorie foods in large portions (Pries, Filteau, and Ferguson) and consuming sweetened beverages (Popkin and Hawkes), as well as low levels of physical activity (Powell et al.) are critical factors that contribute to the development of obesity. Television viewing has also been implicated as a cause of obesity through decreasing physical activity and metabolic rate, while increasing consumption of food and exposure to food advertising (Sahoo, Sahoo, and Bhadoria). Limited accessibility to nutritious food, due to the higher cost or decreased availability of fresh foods, increases the obesity rates among populations with lower income (Hilmers, Hilmers, and Dave).¹

While many studies investigate the ways in which individual behaviors and characteristics affect people's likelihood of obesity, obesity must also be understood at the *community level*. Obese individuals pay roughly 32% more for medical care compared to those who are normal weight (Yusefzadeh, Rashidi, and Rahimi). These effects, however, are not distributed evenly; obesity rates vary greatly between US cities. Of the 500 largest cities in the US, rates of obesity range from 12.2% in Milpitas, California, to 38.8% in Dayton, Ohio (CDC 2015).

Understanding which characteristics of the community are likely to increase obesity rates can help to identify which communities are likely to have high rates of obesity and related health issues and can also inform the types of intervention used to target obesity rates on a city level. This study draws upon city-level data of obesity rates to determine which community-level factors can explain differential obesity rates between major cities in the United States. The effect of religious composition on obesity rates is tested below, as religion has been shown to influence health in several ways.

Religion and Health

Religion (defined as the belief or practice with which each individual identified via the PPRI survey) constitutes an important social determinant of health, demonstrated to affect multiple aspects of physical and mental health. The effects of religion on physical health occur through psychosocial and behavioral pathways (De Rezende-Pinto, Schumann, and Moreira-Almeida) in general showing that religion positively influences a person's overall physical health (Taylor).

Studies have shown that religion has a beneficial effect on a wide range of diseases including heart disease, cancer, and overall cancer mortality (among women) (Shanshan, Stampfer, Williams, and VanderWeele). In their review of studies testing the relationship between religion and health, Chida, Steptoe, and Powell found that religion was consistently correlated with

¹ The Health in All Policies Approach works to improve the overall health of communities through health policies. One goal of the health in all policies integrative approach is to make healthy foods more accessible and facilities for exercise (CDC 2016).

reduced mortality in studies of healthy populations. Religiosity can also lower the risk of health-destructive decisions including high-risk sexual behaviors (Korup et al.), as well as reducing drug, tobacco, and alcohol use (Guo and Metcalfe). These types of behavioral changes in turn result in better physical health outcomes.

In addition to religion's effect on physical health, religiosity can relate to positive mental health outcomes (Soori). While the definition of religion and the measurement of mental health vary between studies, there is a general positive trend between religion – defined as institutional, ideological, or personal attachment – and mental health outcomes (Lorenz, Doherty, and Casey). Those who actively participate in religion have been found to be less depressed compared to their non-practicing or non-religious counterparts (Lorenz, Doherty, and Casey). A religious community can influence health through support groups and meetings held for anxiety or distress and sorrow and hardship. Brown et al. found that religion has a positive impact on smoking cessation. Religiosity and religion serve as protective factors for US immigrants in reducing smoking and initiation of first use (Cartwright).

Religion and Obesity

There are multiple pathways through which religion can affect health. Given the demonstrated association between religion and various aspects of health, could religion offer additional insight into obesity rates? Existing studies have found relationships between obesity and religion, though they vary regarding the populations they study and the relationships that they find. Religious institutions often promote healthy eating among communities (Alvarez-Carrillo, Kawachi, and Riera-Romani).

Cline and Ferraro showed that, among Baptist women, consuming a high level of religious media increased the risk of obesity, possibly associated with the sedentary lifestyle associated with reading or watching television. Kim, Sobal, and Wethington found conservative Protestant men (but not women) had a higher body mass index than those without a religious affiliation. Other religious factors such as attendance at religious services, social support, religious application (how often religious beliefs influenced their decisions), and religious identity (how important it was to marry within the same religious denomination) were related to a higher BMI, although these associations were lost or decreased after controlling for smoking (Kim et al.).

Conversely, other studies have found that religious participation decreases body weight. A study of Korean women in California found that increased frequency of religion-based messages, which discouraged excessive eating and encouraged physical activity, significantly lowered the probability of obesity (Ayers et al.). Tan, Chan, and Reidpath showed that involvement in a religious organization was associated with increased intake of fruits and vegetables and decreased intake of fatty foods. Nie demonstrates the relationship between religion and BMI. This study used two waves of multilevel data from the National Study of Youth and Religion and combined this data with variables from the county-level. After controlling for several county and individual variables, the results of the study were that the higher the Catholic population share the greater the correlation with reduced BMI among individuals. Moreover, for conservative Protestant population share at the county-level there is an association between this religion and higher BMI. Socioeconomic variables at the county level demonstrate the reason for the contextual effect among the relationship between conservative Protestant population share and BMI (Nie).

The limitations of comparing religious racial/ethnic minorities vs. white (multiracial) populations is that religious traditions differ across different groups. For example, PPRI data demonstrates that 59% of Catholics (n=7,113) identify as whites; whereas 34% identify as Hispanic. Religion varies by ethnic composition and there are several denominations of each religion, and race can be a confounding factor between the relationship between religion and health (Pew Research Center).

The conflicting results found in studies of religion and obesity reflect differing definitions of religion and religiosity as well as different pathways by which religion may influence obesity. In this study, data is analyzed using at the city level, using control variables to parse out possible pathways by which religious affiliation can influence obesity. Based on existing studies of the association of religion and health generally, and religion and obesity specifically, diet, social support, and demographic composition are identified as possible mechanisms through which religion affects obesity rates. An outline of these arguments and corresponding hypotheses are below.

Potential Pathways

The effect of religious participation on obesity can occur through multiple pathways; three possible mechanisms tested in this study are outlined. First, many religions include mandates regarding consumption and fasting. Differences in diet by religion and denomination could in turn influence rates of obesity between religious groups by either banning foods, requiring fasting as a part of religious devotion, or prescribing adherents to keep healthy and avoid overeating. In Islam and Judaism, for example, proscription of pork consumption as well as mandated fasting differentiate dietary practices for adherents of these two religions from other religions as well as non-religious persons. In Catholicism, the defining of gluttony as a deadly sin places value on moderation or restriction regarding consumption. If the effect of religion on obesity varies based on the extent to which the religion prioritizes diet as part of religious adherence and practice, then obesity rates would differ by religious denomination even when controlling for demographic and social differences that may exist between religions. While theology does in many cases prescribe dietary practices, much of the impact found in prior studies of religion on health generally, and obesity, specifically, occur through religions' social components (Ansari, Soltero, and Lee).

By providing social networks and community, religions can influence adherents' access to resources and support structures, which in turn improve health outcomes (Everton). Social support and networks provide a greater sense of community contributing to behavior change and therefore better health outcomes. For example, a walking group is helpful for those who are lonely and need someone to talk to and a friend (CDC 2019). Furthermore, social support is helpful in improving health outcomes like physical activity, such as programs to impact adults through greater physical activity. This can influence mental and physical health through the decrease in risk factors for cardiovascular disease like increased BMI and high blood pressure (Cozier et al.). In this case, the potential positive impact of religious involvement on obesity rates should be present whether the religion has theological mandates regarding consumption or not, as the component influencing health is the community provided by religion, not the religious doctrine itself.

The final possible avenue through which to understand differential obesity rates and the role of religion is through an examination of which factors very closely correlate with religious denominations, and how demographic factors (defined as social determinants of health, including age, gender, income status, and education that may confound the relationship between religion and obesity) and cultural factors (defined as lifestyle attitudes and values, specifically relating to level of religion) and different levels of religiosity may contribute to varying obesity rates. If the observed relationship between obesity and religion reflects not the role of religion (social or theological), but rather third variables, which correlate with religion, then the effect of religion on obesity should be seen but disappears after controlling for these additional variables.

Studies have shown that social connections among religious groups benefit health. For example, Strawbridge and colleagues demonstrate that individuals who participated in religious services each week or more frequently at the beginning of the study had a greater likelihood of increasing the number of social connections with friends and family members during the study period. These individuals were also more likely to increase their non-religious community group memberships through greater social connection. Those individuals who participated in religious services each week or more frequently had a 36% lower risk of mortality over the course of the next 28 years compared to those who did not participate as frequently or at all. When friends, family members, and connections with community groups are controlled for the difference reduces to 31% hazard of mortality. This study demonstrates the benefit of being part of a religious group and displays the correlation of religion and social connection and its impact on overall health.

There are some control variables in the analysis (the non-religion variables) including the demographic and cultural variables such as smoking, mental health, physical activity and poverty. Outside of these, the demographic and cultural factors are not controlled for.

With these three possible mechanisms in mind, three models were developed to test which factors influence obesity rates, building in means of differentiating between the three possible pathways, but also acknowledging that the influence may stem from some combination of the three.

Data and Methods

The data for this study come from the 500 Cities Project (CDC 2015), which reports health data by metropolitan area. The data include health-related behaviors and outcomes for major US cities based on survey and census data. Additionally, religion data at the city level is drawn from the Public Religion Research Institute (PRRI), which collects data on religion through surveys. These data provide the percentage of a city's population that identifies as a given religion, over eighteen different religion categories. The unit of analysis for this study is the metropolitan area, using data for all metropolitan areas available in the PRRI data, which totals 30 major cities. Additionally, city-level poverty rates measured by the American Community Survey of the Census Bureau, compiled by the Brookings Institute, are used.

Dependent Variable

The dependent variable in this analysis is the obesity rate for each metropolitan area, available from the CDC 500 Cities Project database for the year 2014. The value represents the percentage of adult survey respondents from a city (excluding pregnant women) who have a BMI greater

than or equal to 30. The percentages ranged from 15.5% obese in San Francisco to 36.4% in Detroit, with a median of 25.3% across the 30 largest metropolitan areas.

Independent Variables

The primary variables of interest in this study are the religious affiliations of the residents of each city in the dataset. These data come from the PRRI and are reported as the percentage of survey respondents from a given city that identify as each religion. The religious affiliations included are Protestant Christian, Catholic Christian, Jewish, and Muslim. Additional religions were excluded due to very low percentages in many of the metropolitan areas. The Christian denominations are further subdivided by racial and ethnic identification of the respondent. This expands the categories to include white Protestant, Black Protestant, and Hispanic Protestant, as well as white Catholic and Hispanic Catholic. While the religious denomination alone can illuminate differences in obesity from prescribed lifestyle habits, further disaggregating the religions by race and ethnicity provides insight into the social influences of religion.

Control Variables

Based on existing studies of the causes of obesity, variables measuring the smoking, mental health, and physical activity from the CDC 500 Cities Project database from 2014 are included. The smoking variable measures the percentage of respondents who have smoked more than 100 cigarettes in their lifetime and currently smoke every day or most days. The mental health measure is the percentage of adults who reported 14 or more days during the past month in which their mental health was not good. Physical activity is measured as the percentage of respondents who indicated that outside of work, they had not participated in physical activities or exercise in the past month. Lastly, the poverty level of the city is controlled for, using 2015 data from the US Census Bureau, measuring the percentage of people in the metro area living below the federal poverty line (\$24,257 for a family of four) (US Census Bureau).

To analyze these data, OLS regression on three different models is used, each with city-level obesity rate as the dependent variable. The first model uses strictly the control variables outlined above, the second includes only religion variables, and the third model combines the religion proportions with the control variables.

Results

To further our understanding of the predictors of city-level obesity rates, a multiple regression analysis of variables is performed and shown in previous studies to increase obesity rates as well as the religion percentages per city. The results of the three models tested are presented in Table 1. Our first model tests only the control variables, which include smoking, physical activity, mental health, and poverty rates. In this restricted analysis, both the proportion of smokers in a city as well as the proportion of those surveyed who do not participate in physical activity are significant indicators of obesity rates. Both variables are positive in direction, indicating that an increase in the proportion of smokers or inactive residents significantly relate to an increased rate of obesity in the city.

The second model tests only the religion variables, excluding control variables to shed light on overlapping significance in the variables. In this model, containing only religious composition, the proportion of residents who are Jewish, white Catholic, and Black Protestant are significantly

related to the city's obesity rate. The effect of Jewish proportion is negative, while the white Catholic and Black Protestant variables are both positive.

Table 1. Multiple Regression Analysis of Variables (OLS Regression Results) DV

Obesity Rates by Metro Area	Model 1	Model 2	Model 3
Smoking	0.839*** (0.214)		-0.242 (0.209)
Mental Health	-0.241 (0.509)		0.515 (0.409)
Physical Activity	0.257* (0.134)		0.677*** (0.115)
Poverty Rate	0.278 (0.251)		-0.008 (0.239)
White Protestant		-0.035 (0.117)	-0.085* (0.047)
Hispanic Protestant		0.238 (0.525)	0.080 (0.209)
Black Protestant		0.489*** (0.126)	0.050 (0.062)
White Catholic		0.401*** (0.118)	0.101* (0.054)
Hispanic Catholic		-0.046 (0.261)	-0.356*** (0.114)
Jewish		-1.508*** (0.519)	-1.374*** (0.287)
Muslim		-0.582 (0.787)	-0.061 (0.327)
Constant	0.921 (3.328)	18.579*** (6.167)	12.132*** (3.514)
R2	0.812	0.676	0.951
Adjusted R2	0.782	0.573	0.921

*p<0.1 **p<0.05 ***p<0.01

In the combined model, in which control variables and religion variables are both included, smoking rate loses significance, while the lack of physical activity variable maintains significance, increasing in significance level and effect size. The lack of physical activity increasing obesity rates can be viewed not strictly as individual behaviors but could reflect the amount of greenspace or public exercise resources in a city. The benefit of increased greenspace is to improve physical activity and contribute to weight reduction, and the reduction of health problems that are developed from high weight status (Dadvand).

From the religious composition variables, white Protestant, white Catholic, Hispanic Catholic, and Jewish are significantly related to obesity rates. White Protestant, Hispanic Catholic, and Jewish are negatively associated with obesity rates, while white Catholic is positively associated with obesity. The percent Jewish residents in a city has the largest effect size of the significant variables, with a one percent increase in the Jewish residents equating to a decrease of 1.374 in the percentage of the city residents who are obese. Additionally, the inclusion of religion rates into the analysis increases the strength of the model from an R^2 of .812 in the first model to .951 in the combined Model 3. Muslim is not statistically significant in the analysis.

Model 1 and Model 2 add to the analysis because they individually separate social determinants of health and religion, and Model 3 shows the relationship between them. After controlling for smoking, mental health, physical activity, and poverty rate, Black Protestant is no longer significant (Model 3). There were three possible mechanisms studied: 1) religious mandates regarding consumption and fasting and diet influencing rates of obesity between religious groups, 2) potential positive influence of religious participation on obesity rates (community provided by religion, not the doctrine/theological mandates regarding diet itself), and 3) cultural and demographic factors influencing the association between religion and obesity. There is a limitation of the data type because it is not known to what extent people are religious or details about their specific practices, so it cannot be stated what exactly about religion causes the relationships between religion and obesity.

In this case, the potential positive impact of religious involvement on obesity rates should be present whether the religion has theological mandates regarding consumption or not, as the component influencing health is the community provided by religion, not the religious doctrine itself.

The final possible avenue through which to understand differential obesity rates and the role of religion is through an understanding of which factors very closely correlate with religious denominations, and how demographic and cultural factors may be captured in the relationship of religion and obesity.

Discussion

Viewing these results considering the three potential pathways outlined earlier, we can determine whether the results support the proposed theory and how further research can be used to strengthen our understanding of these relationships. The *first causal pathway* proposed is the possibility that the relationship between religion and obesity is due to differences in obesity rates by religion that can be attributed to differential religious prescriptions regarding diet. Physical activity, Hispanic, and Jewish were all significant factors impacting obesity ($p < .05$).

The *second hypothesized mechanism* by which religion can influence health in existing studies is by providing social support and community to the participants. In this case, support from others who participate in the religion and the resources available to participants through their religion institutions should positively affect one's health. While this is more difficult to measure on the city level than in studies of personal levels of religiosity, in general, higher levels of religious membership to decrease obesity rates are expected. In the results, this is partially supported. In the combined model, which includes both city-level control variables as well as religious composition, proportion of Jewish and Hispanic Catholic residents each decrease the level of

obesity in the city. The proportion of white Catholics, conversely, increased the obesity rate. In Model 2, which includes only religion variables, there is a positive effect of Black Protestant on obesity rates, however in the combined model, once controlling for other characteristics of the city, the general trend is for religious membership to decrease obesity rates as indicated by Jewish and Hispanic Catholic effect directions.

Lastly, the *third mechanism* by which religion can influence obesity is through other factors, which correlate with both religious membership and obesity. This hypothesis is partially supported when looking at the results of Model 2, which contains only religious proportions. In this constrained model, Black Protestant and white Catholic are both high significant, but lose their significance when controlling for additional city characteristics, including rates of physical activity. The observed correlation between those two religions and obesity rates in Model 2 is capturing additional characteristics about the city that correlate with religion. Additionally, in the combined model, the differential effect size and direction between religions may also capture social characteristics associated with the religions including social class of membership. While the model does account for poverty rates within the city, there are additional measures of income distribution that could be captured by religious composition.

For example, family income levels for Jewish households fall well above the national average (Masci). Given the correlation between income and obesity, it was anticipated that a larger proportion of Jewish households in a city to decrease the overall obesity rate, and vice versa for religious denominations that are generally lower income. The effects of the social aspects of religion are not irrelevant, however, as third variables affecting obesity rates within a given religion, such as income, may then affect other members of the religious community through their interactions and support.

Limitations

There are several limitations in this study. The lack of individual level data is a limitation because there is no information on demographic characteristics, lifestyle habits, and what each individual's religious participation looks like. If this data were available, it would help in the understanding of what is causing the associations between religion and obesity that are seen on a city level. There is also variability in terms of religiosity, and this is difficult to account for. Variability among religiously inclined individuals may be impacted by several factors, including the level of a person's religiosity, frequency of religious service attendance, and social support from religious institutions. Also, the data analyzed contained several denominations of each religion, which increases variability among each individual denomination. This analysis did not focus on every individual sectors/denominations of each religion and the impact of high versus low religiosity among each religion was not accounted for. Lastly, genetic and biological factors of obesity were not explored.

Conclusion

In this paper, literature is applied on the *effects of religion on health to understanding obesity rates in US cities*. With obesity rates increasing in the United States, communities must understand what factors affect their obesity rates. By including measures of religious identification into analysis of obesity rates, this study furthers the understanding of the mechanisms behind the obesity

epidemic in the US, expanding the conversation beyond individual behaviors and predispositions to address social factors, which influence the obesity rates of a community.

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