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Association Between Insufficiently Physically Active and the Prevalence of Obesity in the United States

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Abstract

Background—Numerous public health organizations have adopted national physical activity recommendations. Despite these recommendations, over half of the US population does not meet the minimum recommendation for physical activity, with large variations across individual US states.

Methods—Using the 2005 Behavioral Risk Factor Surveillance System (BRFSS) prevalence data for physical activity and obesity by state, we performed a weighted least squares regression using prevalence of obesity ($\text{BMI} \geq 30 \text{ kg/m}^2$) as the dependent variable and insufficiently physically active (included completely sedentary), age, race, gender, and median household income as the independent variables.

Results—The unadjusted weighted least squares regression revealed a strong correlation between a state's prevalence of obesity and the prevalence of insufficiently physically active ($R = .76$, $R^2 = .58$, $P < .0001$). After adjusting for age, gender, race, and median household income, the prevalence of insufficiently physically active is still a significant predictor of the state prevalence of obesity (partial $R = .44$, $R^2 = .19$, $P = .004$).

Conclusion—Macroenvironmental and socio-political disparities between individual US states that transcend simple state-level demographic factors need to be examined more rigorously to identify unique barriers and promoters of physical activity.

Keywords

environment; exercise; chronic disease; transportation

Background

Obesity and sedentary lifestyles, in both adults and children,^{1–3} are well recognized public health concerns in the United States.^{4–6} Physical activity has been associated with a graded, inverse relationship with body mass index (BMI), abdominal and visceral fat, and weight gain.^{7–10} With the significant benefits in mind, both medically and economically, numerous public health organizations have adopted physical activity recommendations for healthy adults. The American College of Sports Medicine, the Centers for Disease Control and Prevention, the US Surgeon General, and the American Heart Association recommend at least 30 minutes per day of moderate-intensity physical activity on most days of the week.^{7–9}

Despite the widespread message of the beneficial impact of modest amounts of physical activity, the Behavioral Risk Factor Surveillance System (BRFSS) surveys indicate that over

half of the US adult population does not meet the current physical activity recommendations, with a quarter of the population completely sedentary.¹¹ These data stand in stark contrast to the directives of *Healthy People 2010*, in which the goal of increasing physical activity is cited as one of the top priorities to abate the increasing prevalence of obesity and sedentariness.¹² With many of the public health approaches to promote physical activity still inchoate, it might be useful to better quantify and understand national- and state-level disparities in physical activity participation that might contribute to the striking increases in obesity in the United States.

The prevalence of obesity and physical activity, independent of age, race, gender, and socioeconomic status (SES), among the individual US states might be quite different, with many unanswered questions as to why different states are affected to a greater or lesser degree. It is important, at this point, to examine possible state-level disparities in both health-related behaviors and obesity levels that tend to transcend simple state-level demographic variations. As scholars, regulators, and the public consider changes that might lead to reductions in current obesity levels or prevent further increases in the prevalence of obesity, we may ask whether there is evidence that variations in the macroenvironment can impact physical activity and obesity levels.¹³

To the extent that health behaviors, such as physical activity, cluster together within states and that such clustering is not merely the result of state differences in demographic factors such as the distribution of age, race, or SES, then other state-level factors must be at play and credence is lent to the proposition that modifiable macroenvironmental factors may be identified as targets for intervention.

The purpose of the current study was to examine the 2005 BRFSS data to quantify a possible association between the prevalence of obesity and not meeting the current recommendations for physical activity after controlling for differences in common state-level demographic factors for all 50 states.

Methods

The Behavioral Risk Factor Surveillance System (BRFSS) data were used in this analysis. A detailed description of BRFSS methodologies has been previously reported.¹⁴ Briefly, BRFSS is an ongoing, state-based, random-digit-dialed telephone survey that employs a multistage cluster design. BRFSS collects information on health risk behaviors and preventive health practices related to the leading causes of death from the US civilian, noninstitutionalized population age ≥ 18 years. For the following analysis, conducted in 2007, we used the 2005 prevalence estimates for physical activity and obesity provided by the BRFSS prevalence calculator, which incorporates the complex sample-weighting procedures used by the BRFSS. To determine if individuals were physically active, interviewers asked a series of questions to determine if the interviewees acquired at least 30 minutes of moderate physical activity 5 or more days per week or vigorous physical activity for at least 20 minutes 3 or more days per week. If they did not meet this guideline, the interviewees were considered insufficiently physically active.¹⁴ Therefore, in the current examination, the moniker *insufficiently physically active* captures both the prevalence of insufficiently physically active and completely sedentary cohorts. BMI was calculated using self-reported height and weight, and obesity was defined as a BMI ≥ 30 kg/m².

(For more information on the BRFSS, the reader is referred to www.cdc.gov/brfss/index.htm where an extensive description of the survey methodology is given.)

Using the 2005 prevalence data for physical activity and obesity by state, we performed a weighted least squares linear regression (weighted by the variance of each state's estimates)

using percentage of obese by state as the dependent variable and insufficiently physically active ($100 - \% \text{ of a state's population that met physical activity guidelines} = \% \text{ insufficiently active or completely inactive}$), age, race, gender, and median household income as independent variables for all 50 states.

Results

The prevalence of obesity ($\% \text{ with BMI} \geq 30 \text{ kg/m}^2$) within each of the 50 states ranged from 17.8% (Colorado) to 30.9% (Mississippi) with a national mean of $24.6 \pm 3.0\%$. The prevalence of insufficiently physically active ($\% \text{ not meeting the ACSM/CDC recommendations}$) ranged from 42.3% (Vermont) to 65.3% (Kentucky) with a national mean of $51.4 \pm 5.6\%$. A simple Pearson correlation revealed a significant association between the prevalence of insufficiently physically active and obesity by state ($r = .67$, $R^2 = .45$, $P < .0001$). Because the Pearson correlation depends on the assumption of normality, we also conducted a Spearman rank correlation, which revealed similar results between the absolute correlation coefficients ($r = .66$, $R^2 = .44$, $P < .0001$).

Figure 1 presents the results from the unadjusted weighted least squares linear regression, which revealed a strong correlation between the state prevalence of obesity and the prevalence of insufficiently physically active, age, race, gender, and median household income (full model: $R = .76$, $R^2 = .58$, $P < .0001$). After adjusting for age, gender, race, and median household income, not meeting the physical activity recommendations is still a significant (and the strongest) predictor of the state prevalence of obesity (partial $R = .44$, $R^2 = .19$, $P = .004$; $\beta = 0.232$, 95% CI = 0.082–0.387; $F_{5,40} = 10.82$, $P < .0001$).

Conclusion

To our knowledge, this is the first study to examine the relationship between physical activity and obesity by state. Our findings show a highly significant positive association between insufficiently physically active and the prevalence of obesity at the national level that remained after adjusting for age, race, gender, and median household income. Insufficiently physically active accounted for ~20% of the state-level variance in the prevalence of obesity after controlling for state-level demographic factors that are associated with physical activity and obesity. This finding is an important first look into disparities in the prevalence of physical activity and the impact on state-level prevalence of obesity across the United States. Many of the state-level demographic variables are not malleable, such as age, race, and gender, but this report demonstrates that participation in physical activity, at the state-level, might be a robust factor that affects the prevalence of state-level obesity. The wide variation in physical activity and obesity across the United States, which transcends common state-level demographic characteristics, lends credence to the conjecture that environmental constructs might be important future research and intervention targets.¹⁵

Similarly, Sharpe and colleagues¹⁶ reported an inverse association between BMI and physical activity in individuals in South Carolina using 2001 BRFSS data. Notably, in the aforementioned report, SES has been implicated as an important factor that influences physical activity participation rates, but it should be noted that obesity and physical inactivity continue to increase across all SES groups, and participation rates in physical activity among lower SES groups is commonly reported as having community and environmental origins.^{13,15,17,18} Health promotion campaigns have been primarily focused on education and evoking action at the individual level, and these efforts have had little impact on the prevalence of physical activity at the national level.¹⁵ Conceivably, environmental factors are mitigating these efforts, and greater emphasis needs to be placed on implementing environmental and community adaptations that allow for greater participation in physical activity (ie, walkable communities,

access to recreational facilities, bike paths, etc). A logical first step as highlighted from the current study is to elucidate underlying mechanisms in environmental and cultural disparities between states such as Colorado that have higher rates of participation in physical activity and lower prevalence of obesity and states such as Mississippi that have lower rates of participation in physical activity and higher prevalence of obesity.

Environmental and sociopolitical factors have been postulated to explain some of these differences and may exert a more potent influence on the increasing prevalence of obesity than previously thought.¹⁹ In the past decade, research exploring environmental factors (ie, built environment) has increased, and environmental changes such as the increased use of technology and urban sprawl have been implicated in the reduction of both occupational and leisure-time physical activity.¹⁹ Coupled with greater food availability, these changes to the built environment have contributed to an “obesogenic” or “toxic” ecosystem that contributes to sedentariness and obesity. In the current report, caloric data were not available, which would have strengthened the current analysis, but currently no data exist, nationally. Because nutrition and physical activity are intricately linked with the prevalence of obesity, caloric disparities as well as nutrient intake across the United States would provide additional insight into the clustering of behaviors that convey a propensity for the obesogenic milieu. To date, much remains unknown about sociopolitical and macroenvironmental differences across states that contribute to this deleterious ecosystem that might remove or place barriers to participation in physical activity and concurrently result in higher state-level obesity rates.

Each state in the United States has been given the charge to meet the *Healthy People 2010* targets for reduction in the prevalence of obesity.¹² To support these efforts, several campaigns have been developed by the CDC to target individual-level behaviors such as the CDC’s Nutrition and Physical Activity Program to Prevent Obesity and the Steps to a Healthier US.^{20,21} Collaboration with local governments, city planners, media outlets, schools, and employers to not only influence individual behaviors, but to reduce community barriers that limit opportunities to be more physically active, is essential. However, much still remains unknown about the effectiveness of community-based initiatives that promote community and individual support for adopting a more physically active lifestyle, which makes these projects difficult to fund. The current data provide evidence that there are wide variations in physical activity participation across the United States, and these variations have a substantial impact on the prevalence of obesity. At this juncture, with the majority of the US population overweight or obese and insufficiently active to promote health or completely sedentary, it appears critical to examine and develop a better understanding of environmental influences across the spectrum that influence clustering of behaviors such as physical activity (ie, Colorado versus Mississippi). These endeavors might provide insightful information into unique factors that can be addressed to enhance the likelihood of sustainable environmental interventions that increase physical activity participation and reduce obesity and sedentariness. In the short term, even if the prevalence of physical activity was increased, the effect on obesity prevalence might be modest. Nonetheless, increasing physical activity participation has been reported to prevent further unhealthy weight gain,⁹ and, even in the absence of weight loss, physical activity has a salutary effect on many obesity-related sequelae.²²

In conclusion, the prevalence of insufficiently physically active is associated with the prevalence of obesity nationally and accounts for a considerable amount of the state-level variation in obesity that transcends demographic characteristics. Further examinations into cultural, environmental, and sociopolitical disparities between states is needed to identify and clarify potentially modifiable factors that prevent a physically active lifestyle at the population level, and perhaps the next step is to closely examine these variables in states that currently have high rates of participation in physical activity and low prevalence of obesity and vice versa.

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Figure 1.

Modeling the prevalence of obesity by state (adjusted R^2 represents the association between insufficiently physically active and obesity by state after adjusting for age, race, gender, and median household income ($n = 50$)).