Obesity

The Varying Effects of the Food, Built, and Socioeconomic Environment on BMI

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Although federal, state, and local health authorities have invested substantively in a diverse range of interventions to combat the obesity epidemic during the past decade (1-3), the original expectation of achieving a modest decline in this condition's prevalence, as measured by BMI, has not been fully realized. According to the National Health and Nutrition Examination Survey 2015-2016, the prevalence of obesity among US adults and youth was still 39.8% and 18.5%, respectively (4). Although this development does not necessarily suggest a global failure in public health's response to this epidemic, it does warrant some introspection and review of the approaches being taken to address this public health threat. For example, lingering questions remain: Are policies implemented to improve the quality of food environments effective and adequately supported by evidence? Do the mixed results commonly seen with built environment interventions suggest a poor return on investment for these types of upstream interventions (or is it just simply too early to tell)? How influential is socioeconomic status on health behaviors such as physical activity and sedentary lifestyles?

In the latest issue of *Obesity*, several studies attempted to shed further light on these complex subjects. In the Rummo et al. (5) study, researchers used repeated cross-sectional data from the Behavioral Risk Factor Surveillance System (2003-2012) to examine the influence of county-level characteristics on BMI in all counties within the United States. Using a random-effects, within-between model, they were able to show that an increase in active commuting within counties was associated with a 0.51-kg/m^2 decrease in BMI over time. In contrast, unemployment, a social determinant of health, was found to be associated with an increase in BMI (ß=0.17), affirming the importance of socioeconomic factors on heightened obesity risk. In this study, active commuting was defined as "the proportion of total workers age >16 years who commute by walking, biking, or using public transportation."

In another national study, Tarlov et al. (6) found that veterans who lived in more walkable communities tended to be more physically active and weighed less. Neighborhood walkability was found to be associated with reductions in BMI over time for both men and women living in large urban areas in the continental United States. The BMI reductions, however, were small and more pronounced among younger age groups. Study participants were derived from the larger Weight and Veterans' Environments Study (WAVES) cohort of veterans who were receiving Department of Veteran Affairs primary health care services. Generalizability of these results to the general US population was, thus, limited.

In yet another study of veterans, Graham et al. (7), showed that greater engagement in the Veterans Health Administration's MOVE! weight management program was associated with older age, female sex, white race, being married, and being retired. These findings suggest that variation in program participation may have been influenced by factors such as food access, recreational opportunities, and natural amenities found at the county level.

In the Elbel et al. (8) analysis of a population-based sample of public school children in New York City, proximity of fast-food restaurants was found to be inversely related to childhood obesity in the city. The authors concluded that their finding supports a need to pivot public policy toward promoting outlets that "sell healthier foods" and restrict access to "outlets selling less healthy items."

Finally, Walker et al. (9) showed that several features of the food environment have varying associations with obesity in three Canadian cities, Vancouver, Hamilton, and Québec City. The ratios of fast-food to full-service restaurants and bars/pubs to liquor stores were positively associated with obesity, as measured by BMI ≥ 30. The researchers defined "features of the food environment" as types of stores using the following categories: fast food, full-service restaurants, markets/grocery stores, bars/pubs, and liquor stores.

Findings from all five studies contributed to the often elusive but emerging "jigsaw puzzle" that is the obesity epidemic. Although all five furthered our understanding of the potential effects envisaged by intervening on the food, built, and socioeconomic environment, the one overarching takeaway from this research is that BMI varied by the type of intervention implemented and for each intervention; the impact of BMI appears to be further affected by geography (likely interactions with other interventions) and by the circumstances or contexts at the community level. This heterogeneity in findings is consistent with an emerging body of evidence suggesting that there is a need for additional study of strategy interventions on obesity outcomes, with a focus on understanding the interactions of interventions implemented at multiple levels and on the combining of these interventions to achieve aggregate effects (Table 1) (10-13). Some of this work is already under way, seeking to confirm the collective health impact of using combination strategies to halt the obesity epidemic (10,12). O

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TABLE 1 Where the 5 published studies fit in the emerging literature on obesity interventions in the food, built, and socioeconomic environment

Study	Methods used and analysis conducted	Principal findings	Environment		
			Food	Built	Socioeconomic
From the latest issue of Obesity					
Rummo et al. (5)	A random-effects, within-between model was used to estimate both cross-sectional associations and longitudinal associations between several food, built, and socioeconomic variables and BMI. The authors integrated temporality into the estimation of repeated cross-sectional data from the BRFSS (2003-2012) for all US counties.	Association with BMI: a negative between-county association for active commuting and positive associations for unemployment and limited-service restaurants.	X	X	X
Tarlov et al. (6)	Linear regression models with person fixed effects were used to estimate associations between walkability and BMI. The study is a retrospective longitudinal study of US military veterans who use VA health care. VA clinical and administrative data (2007-2014) were linked to environmental measures constructed from public (2006-2014) and proprietary (2008-2014) sources.	The study found evidence supporting a causal effect of neighborhood walkability on BMI in both men and women in some age groups, but the expected BMI change associated with improving walkability was small.		X	
Graham et al. (7)	A cross-sectional analysis of the number of visits per person (outcome measure) at 12 months after Veterans Health Administration MOVE! program enrollment was conducted to examine the distribution and relationships between participant demographics, program attributes, and county-level characteristics. The unit of analysis was the participant (veteran). The total number of participants included in the analysis was 321,624.	Greater program engagement was associated with older age, female sex, white race, being married, and being retired. In addition, county-level characteristics were related to variation in engagement. For example, after accounting for similarities between nearby communities, engagement at 12 months was 3.1 visits higher for each additional farmers' market per 1,000 population (P=0.01).	X	X	
Elbel et al. (8)	Height and weight data (a total of 3,507,542 student-year observations) from the 2009-2013 annual FitnessGram assessment of New York City public school students were used to evaluate the relationships between weight status outcomes and the distance to several food outlet types (including supermarket) in the city. Statistical analyses utilized ordinary least squares regression modeling.	Living farther than 0.025 mile from the nearest fast-food restaurant was associated with lower obesity and obesity/overweight risk and with lower BMI *z* scores as calculated using FitnessGram data.	X		
Walker et al. (9)	Logistic regression models were used to examine the associations of interest. The study was a substudy of the PURE study, comprising a participant assessment and an environment assessment completed on >8,000 participants from 3 Canadian cities during 2006-2009.	Ratios of fast-food to full-service restaurants and of bars/pubs to liquor stores were positively associated with obesity, as measured by BMI. The ratio of bars/pubs to liquor stores was positively associated with abdominal obesity, as measured by WC. No associations were found between markets and either BMI or WC.	X		
Simulation analyses that examined multiple or combinations of obesity-related interventions					
Nianogo and Arah (10)	The VILA Model was used to estimate the incidence and prevalence of obesity and type 2 diabetes under current and hypothetical interventions among 98,000 individuals. The VILA Model is an agent-based model of the 2 conditions.	The 64-year risk of obesity was 0.892 under the natural course, 0.876 under the physical activity intervention, and 0.864 under the fast-food intervention. Implementing health interventions continuously and in combination with other interventions can reduce the burden of obesity.	X	X	

TABLE 1. (continued).

Study	Methods used and analysis conducted	Principal findings	Environment		
			Food	Built	Socioeconomic
Kuo et al. (11)	Health impacts of multiple obesity prevention strategies in Los Angeles County were forecasted using the PRISM model, a CDC-supported, Web-based system dynamics model.	By 2040, implemented strategies in the food and built environment and related to media have the potential to reduce the number of youth (–29,870) and adults (–94,136) with obesity, reduce the number of youth (–112,453) and adults (–855,855) whose activity is below recommended levels of physical activity, and reduce the number of youth (–14,544) and adults (–28,835) who consume excess junk food, as compared with baseline (2010-2011).	X	X	
Babey et al. (12)	Agent-based modeling was used to examine and forecast potential health impacts of SNAP-Ed strategies focused on obesity prevention (e.g., nutrition education, farmers' markets, healthy retail, community gardens, food and beverage standards) in 2 SPAs (SPAs 4 and 6) in Los Angeles County. A cost analysis of the interventions for these regions was also conducted.	In SPA 4, the estimated prevalence of obesity in 2040 would be 45% if SNAP-Ed strategy interventions were implemented and continued (vs. 50% if there were no SNAP-Ed strategy interventions). In SPA 6, the parallel results would be 54% vs. 58%. Cost analysis estimates suggest a return on investment of 29.75 for SPA 4 and 8.37 for SPA 6 if these SNAP-Ed strategy interventions were implemented and continued.	X		

BRFSS, Behavioral Risk Factor Surveillance System; CDC, Centers for Disease Control and Prevention; PRISM, Prevention Impacts Simulation Model; PURE, Prospective Urban Rural Epidemiology; SNAP-Ed, Supplemental Nutrition Assistance Program Education; SPA, Service Planning Area; VA, Department of Veterans Affairs; VILA, Virtual Los Angeles; WC, waist circumference.

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