

Public Health and the Built Environment: Emerging Evidence and Complexity

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Island Press recently published a book that he, Peter Engelke (George Washington University), and Dr. Tom Schmid (U.S. Center's for Disease Control and Prevention) recently completed titled, *Health and Community Design, The Impacts of The Built Environment on Physical Activity* and is about to release a second book *Urban Sprawl and Public Health* by Dr. Howard Frumkin, Dr. Lawrence Frank, and Dr. Richard Jackson.

OVERVIEW

Recent findings document that more compact urban environments, where uses are intermixed and streets are interconnected, are associated with higher levels of physical activity¹ and lower levels of obesity^{1,2,3,4}. Obesity is a well documented health hazard impacting both morbidity⁵ and mortality⁶. Thus far, most of the variation in the level of physical activity observed in different types of urban environments has been attributed to the amount of walking and biking that is self-reported through household travel surveys from respondents in different types of urban environments. In this paper, urban environments are deemed walkable for utilitarian purposes if they are more compact, mixed use, and have inter-connected street networks. As shown in Figure 1, the street network in which one lives (cul-de-sac or connected grid) impacts the distance traveled to access destinations – often resulting in walkable or non-walkable trips.

Figure 1 - Cul-De-Sac Vs Grid Environments

1.3 Miles vs. 0.5 Miles



Images are same scale.
Source: Frank, Engelke, and Schmid. 2003.

Research within the transportation and urban planning literature has documented that the amount and proportion of walking and biking increases with residential density, mixed use, and street connectivity, when adjusting for socio-demographic co-variables including age, income, and educational attainment^{7,8}. As a result, a significant new relationship between urban form, travel behavior, and public health is currently being established within the scholarly literature^{9,10,11,12}.

However, nearly all of the research linking the built environment with travel behavior to date is of a quasi-experimental, or more specifically, a cross-sectional research design whereby travel and physical activity levels are observed for different respondents within different types of urban environments. A significant hurdle, therefore, remains in the ability to rule out other factors that impact how much one chooses to walk. Perhaps the most important of these exogenous factors being the predisposition or attitudes one has towards walking and the self-selection of a walkable environment in which to live¹³. Thus a significant factor within the current urban planning, and now public health dialectic on this point is over whether or not it is the built environment that is shaping behavior or the underlying preferences that predetermine both travel and residential location choice. To address these limitations, researchers are beginning to develop study designs that test physical activity levels of participants before and after they move from one type of urban environment to another.

AUTO AND TRANSIT USAGE AND PHYSICAL ACTIVITY

Urban form is not the only environmental predictor of physical activity. A key ingredient to increased walking and biking is the ability to access destinations with relative ease through public transportation¹⁴. This is a critical point as residents and employees of transit-oriented environments are able to overcome the near "status quo" of auto dependence for both work and non-work purposes through an integrated system of walking and biking for local accessibility and transit for regional mobility. Using transit requires some form of walking or biking to get to and from transit to actual destinations. Transit riders are required to walk or bike more than their auto-dependent counterparts. In urban environments that support walking, biking, and transit, residents are able to forgo having one car per person, often in favor of one car per household, or even living without a car. A variety of policy initiatives have emerged within Canada and the United States to support the ability to reduce auto reliance. While too many to name, a few of the most promising include Car Sharing, Location Efficient Mortgages, and Parking Cash Out:

- Car Sharing exists in both Canada and the United States and involves a monthly membership fee to a cooperative that owns cars allowing participants to forgo personal car ownership in lieu of having a car at their disposal when needed;
- Location Efficient Mortgages exists in a few regions of the United States and allows prospective homebuyers to borrow more for homes that are located in more central, pedestrian and transit-oriented areas, and provides an incentive to live in a more walkable environment¹⁵. The premise from the lending side is that reduced auto usage translates into reduced costs for transportation and a sustained net increase in household dollars available to service the debt on the mortgage;
- Parking Cash Out exists formally within the United States but is transferable as a practice to Canada. It allows employers to pay their employees the same amount of cash they would otherwise pay for providing parking – if the employee chooses to forgo their parking space at work.

Reduced auto usage not only results in personal health⁴ and economic benefits¹⁶, but also in important environmental benefits through reduced air pollution¹⁷, and long understood reductions in energy consumption¹⁸. These latter benefits are shared across populations and result in an improved quality of life across a broad spectrum of the population.

CURRENT STATE OF THE PRACTICE

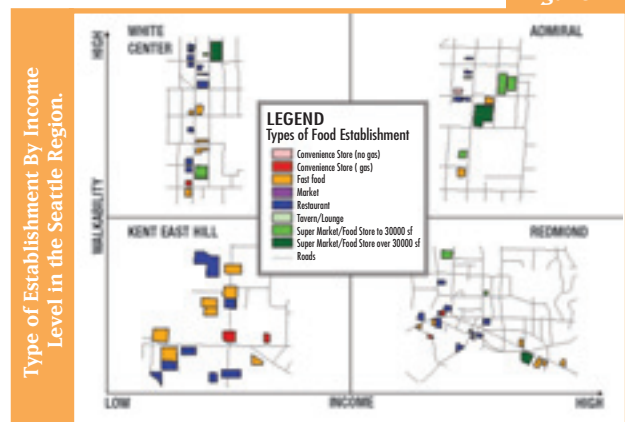
While travel behavior and more specifically, "active transportation" has been linked with physical activity and obesity levels, there are other aspects of the built environment that impact activity patterns and perhaps diet as well¹⁹. To date, most of the research relating

the built environment and physical activity are of self-reported measures of travel choice – e.g. how much someone reports they walk or bike²⁰. More recently, physical activity has been objectively measured through the deployment of accelerometers that are calibrated to monitor activity levels by the minute. Accelerometers provide estimates of movement when worn on the hip and have been shown to be reliable and valid in the estimation of adult physical activity^{21,22}, particularly of moderate intensity activity²³. Research now exists demonstrating that objective measures of physical activity, derived from accelerometers, is significantly associated with objective measures of the built environment derived from computer based geographic information systems (GIS). The number of minutes of moderate physical activity derived from accelerometers was found to increase significantly with both self-reported¹ and objective measures of walkability²⁴.

Current research suggests that transportation related physical activity explains some of the variation between urban form and body mass index⁴. However, a recent study of relationships between the built environment and obesity in Atlanta shows a very strong inverse association between the level of land use mix and obesity – with a strength of association exceeding income and educational attainment⁴. Other urban form factors including street connectivity and density were not as strongly associated with obesity. Therefore, some aspect of mixed use is highly correlated with obesity where other urban form predictors of walkability are not. Mixed use captures the presence of non-residential uses within a walkable distance of participants' households. Observations with more mixed use have more commercial floor area and more restaurants, more grocery stores, and more eateries overall. Therefore, increased levels of mixed use associated with lower BMI and obesity aligns with increased access to a variety of food outlets.

Higher income is also associated with reduced levels of obesity^{25,26}. Figure 2 below shows four neighborhoods in the Seattle Region – lower income Martin Luther King and Kent East Hill Areas and higher income West Seattle Admiral District and Redmond areas.

Figure 2



Income levels were based on census block groups. While solely for illustrative purposes, it is obvious that there is a prevalence of grocery stores and restaurants in the higher income communities, and of convenience and fast food outlets in the lower income communities. Body mass index and resulting obesity levels are a function of diet (energy intake) and physical activity (energy expended). Current models predicting obesity only explain a fraction of the variation in obesity as a function of physical activity, leaving the majority of the variation in obesity unexplained. Research is sorely needed to assess the collective effects of community design and types of available food outlets on physical activity and diet, and resulting effects on obesity.

Preliminary findings from the Neighborhood Quality of Life Study presented at the Society of Behavioral Medicine Conference this past year showed higher levels of physical activity within the more walkable Admiral District and Martin Luther King Areas and less physical activity within the less walkable Kent East Hill and Redmond areas. However, obesity levels are highest in the lower income Martin Luther King and Kent East Hill communities suggesting the possibility that some systematic differential may exist in diet between higher and lower income communities. Based on the images in figure 2, it is at least possible that this potential difference in diet is a function of the different types of food outlets that populate these higher versus lower income environments.

CONCLUSION

An exciting and innovative form of interdisciplinary research is emerging documenting the linkages between physical aspects of community design, human activity patterns, and resulting health related outcomes. Recent research suggests that the degree to which communities are mixed use, compact, and offer connected street networks impacts the levels of physical activity of area residents. Findings further suggest that body mass index and obesity levels are higher amongst residents of less walkable environments. However, this is a very new area of inquiry, and significant limitations remain with these new findings, and their ability to be readily generalized and molded into plausible health-based interventions. While there is consensus that residents of more walkable environments are more physically active, it is unclear if increases in physical activity are due to the physical environment itself, or due to the predisposition of the residents that self-select to reside in these communities.

Recent interest in the linkage between the built environment and public health has primarily surrounded the emerging obesity pandemic. Increases in the rates of obesity since the 1980s in many

westernized nations are alarming and cause for considerable concern⁵. While increased walkability has been found to be associated with reduced odds of obesity in two separate studies^{3,4}; the majority of the variation in the odds of being obese remains unexplained. Moreover, recent results suggest that the aspect of urban form most closely associated with obesity is land use mix, which captures the presence of various types of food establishments within a walkable distance to area residents. Research has demonstrated an inverse relationship between income and obesity^{25,26}. It is therefore postulated here that higher odds of obesity and associated health risks in lower income communities may be a function of a higher prevalence of fast food and convenience stores, and lower prevalence of outlets offering fresh fruit and produce.

To date, no research has collectively assessed the effect of walkability and food environments on obesity. One study, the U.S. National Institutes of Health (NIH) funded Neighborhood Quality of Life Study (NQLS) is underway within 32 communities within the Seattle and Baltimore regions to compare physical activity and obesity levels across walkable and unwalkable environments. Recent initiatives by the Canadian Institutes for Health Research (CIHR) and the Robert Wood Johnson Foundation are beginning to move the research agenda towards a more interactive set of studies that crosswalk between physical activity and nutrition. Through an emerging awareness of the collective impacts of diet and activity patterns, it is now becoming possible to assess this interface between the built environment, physical activity, and nutrition. Anecdotal evidence would suggest that both food environments and walkability collectively impact obesity. When objectively measured, systematic variations between the make up of food environments in higher and lower income areas will likely reveal important information for public health.

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