Editorial

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Enduring challenges in estimating the effect of the food environment on obesity

Steven Cummins, Christelle Clary, and Martine Shareck

Healthy Environments Research Program, Department of Social and Environmental Health Research, London School of Hygiene and Tropical Medicine, London, United Kingdom

Exposure to a poor-quality food environment is hypothesized to amplify individual-level risk factors for an unhealthy diet. Inequalities in exposure to these poor-quality food environments are therefore thought to be one of the mechanisms that drive the production of inequalities in diet and therefore obesity. This is the basic premise of Mazidi and Speakman's article (1) in this issue of the Journal, which explores associations between densities of fast-food and full-service restaurants and obesity in an ecological study that uses national secondary data in the United States. The authors report that the density of fast-food and full-service restaurants is not associated with county-level obesity prevalence, after adjustment for a number of socioeconomic factors. The authors also report that the proportion of total energy intake attributed to the consumption of foods purchased from these establishments is estimated to be 15.9%. They conclude with the suggestion that policymakers should consider shifting their focus to the purchase and consumption of food outside of these facilities. The authors do a good job of presenting an interesting national study and discussing its strengths and weaknesses. However, there remain a number of limitations, which means that we should be cautious about the results presented in this study and therefore the conclusions drawn from them. In this editorial we focus on limitations that are present within the current article, but that are not necessarily unique to it, and that continue to affect much of the epidemiologic work in the field.

First, a key issue is the correct specification of the environments to which people are exposed, variously described as the "local" trap (2) or the uncertain geographic context problem (3). If the specification of context for the outcome and population of interest differs from the true causally relevant context for that outcome and population, then this can lead to inferential errors by misclassifying and underestimating an individual's true exposure (4). As a result, there is now a consensus that the utility of using routine administrative units as proxies for contextual exposure in this area of work is limited and instead we should be moving to "activity-space" approaches (5). Activity-space approaches seek to move us away from the notion of routine administrative units (e.g., counties used in the study by Mazidi and Speakman) as the true causally relevant context for the assessment of environmental risks because they do not give a true representation of the environments to which people are exposed and the environments that might matter most, such as neighborhood, home, or school. This misspecification therefore weakens the ability to detect potential associations (4). Recent research has shown the utility of the use of activity space–based approaches in identifying positive associations between exposure to the fast-food environment and diet by providing a more accurate assessment of true environmental exposures by including both home and work (6).

Second, in addition to correctly specifying the relevant context, how we characterize exposures with the use of routine secondary data is also increasingly important. Recent work has suggested that the use of absolute measures of density as proxies for single environmental risks, such as fast-food outlets or full-service restaurants, may not be the best way to characterize exposure. Increasingly, relative measures of exposure—where single environmental risks such as exposure to fast-food outlets are expressed as a ratio or proportion of all food retail outlets—have been found to more consistently predict dietary behavior (7). The use of relative measures simultaneously accounts for exposure to competing opportunities to consume both healthy and unhealthy food, by expressly capturing the diversity of the local retail environment. A study that used the same underlying data as used in Mazidi and Speakman's study showed that associations are complex and that the relative number of fast-food restaurants to full-service restaurants is associated with weight status, indicating that local retail mix is potentially more important than absolute measures (8). Similar findings have been reported for other components of diet (9).

Third, the use of global regression models in studies of the environmental determinants of diet relies on the assumption that a stationary relation exists—that is, parameter estimates describe an invariant relation between exposure and outcome across space. However, studies have emerged that challenge this stationarity assumption. Spatial regression modeling techniques that allow for spatial variations in parameter estimates have highlighted spatial variations in associations between a range of environmental exposures and outcomes such as diet (10) and obesity (11) and in the magnitude and direction of effects (7). In addition, spatial regression modeling, when compared with global modeling, has shown

Address correspondence to SC (e-mail: steven.cummins@lshtm.ac.uk).

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better performance in terms of improved goodness-of-fit, increased R^2, and decreased spatial autocorrelation in regression residuals (7). This promotes the idea that environmental factors may be important for diet; however, this may not be a global phenomenon, but rather, exposure-outcome relations may be present in some places and not others.

Finally, studies that investigate the environmental antecedents of outcomes that are more distant from the exposure are prone to residual confounding. This is particularly problematic in studies that investigate relatively distal outcomes such as obesity instead of more proximal outcomes such as diet. Because obesity is a function of a variety of health behaviors (diet, physical activity, and sedentary behavior), the omission of a measure of physical activity as a key confounding variable, as is the case here, may lead to the erroneous interpretation of estimated effects.

All of the above are potential sources of error in the estimation of the association between the fast-food and full-service restaurant environment and diet. Overall, although this study usefully contributes to the evidence base, it does not provide convincing evidence for the need to shift policy attention away from the potential influence of the fast-food and restaurant environment on obesity.

All of the authors read and independently evaluated the manuscript upon which this editorial is based, then discussed it and agreed to a structure for the editorial. SC wrote the first draft of the editorial, and CC and MS commented on and added to it. It was then discussed by the authors and edited to create an agreed-upon final version. The authors had no conflicts of interest.

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