

## Invited Commentary: Places, People, and Health

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A growing body of research in epidemiology and public health has examined how characteristics of the places where people live are related to a variety of health outcomes, including health-related behaviors (1–4), prevalence and incidence of disease (5–7), and mortality (3, 8–13). The paper by Balfour and Kaplan (14) in this issue of the *Journal* examines how neighborhood characteristics are related to functional loss in the elderly. The fact that health varies across geographic locations is well-established (15). The assumed explanation for these geographic differences (particularly in the modern era of epidemiology, with its emphasis on individual-level risk factors) has usually been that areas differ because of the characteristics of the people who live in them. In recent years, however, there has been renewed interest among social scientists in the ways in which neighborhood contexts may affect individual-level outcomes (16, 17). For example, neighborhood characteristics have been related to employment and single parenthood (18), violence (19), and child development (20). In public health, it has been argued that neighborhoods may also be relevant to health (21–25). Contextual and multilevel analyses have been used to investigate area effects on health after accounting for individual-level factors (26–28). The persistence of an independent area effect would suggest that things about the area itself are important to the health of its residents. Research on neighborhood effects on health has been part of resurgent interest in the social determinants of health and in moving beyond causal explanations that focus exclusively on the characteristics of people. However, the investigation of neighborhood effects is not only of academic interest: The demonstration of a causal link between neighborhoods and health would have implications for disease prevention and health policy.

Although existing research has, for the most part, documented an independent effect of neighborhood socioeconomic characteristics on health after controlling for individual-level socioeconomic indicators (24, 28), many unresolved issues remain. The magnitude of neighborhood effects and their relative importance have varied (24, 28). More fundamentally, questions remain regarding whether these associations truly reflect causal processes. A key criticism, enunciated

many years ago by Hauser (29) in his critique of contextual analysis, has to do with misspecification of the model at the individual level or residual confounding by individual-level variables. Existing work has attempted to address this critique through stratification and tight control for individual-level variables (mainly individual-level socioeconomic indicators, which are perceived to be the key confounders in these types of analyses) (24). This approach has its limitations. Skeptics will argue that measurement error in individual-level variables remains a possibility. Moreover, to the extent that neighborhood characteristics influence the achieved income, education, or occupation of residents (16, 18, 30), individual-level socioeconomic indicators may partly mediate the relation between neighborhoods and health, making adjusted estimates underestimates of true neighborhood effects. This is related to the broader question of which individual-level variables researchers should control for in determining whether associations of neighborhood characteristics with health are causal, given that individual-level constructs necessarily mediate any causal neighborhood effects on health. It is also possible that people of low socioeconomic position are at higher risk of adverse health outcomes due, in part, to the neighborhoods in which they live, raising additional questions about the true meaning of “adjusted” estimates.

Fundamentally, these issues point to some of the limitations of the analytic approaches commonly used in epidemiology when they are applied to examining complex causal models and drawing causal inferences regarding elements of these models (31, 32). Although research on neighborhood effects has become methodologically sophisticated in accounting for nested sources of variability (26, 27), little work has been done on the development and use of analytic techniques that may be more appropriate to elucidating the complex causal relations likely to be involved. This, however, is a methodological challenge faced by epidemiology even when dealing exclusively with biological factors, which are themselves part of complex causal systems. In fact, many of the analytic issues that arise when examining neighborhood effects on health are present throughout the continuum from society to molecules. These analytic issues include, for example, nested data structures, variables and units of analysis at multiple levels, contextual effects, distal causes, and complex causal chains with feedback loops and reciprocal effects. Alternative analytic techniques that better account for and capture the complex set of relations thought to be operating will aid in the investigation of causal neighborhood effects and will contribute to epidemiology generally.

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An additional and equally important approach to strengthening inferences regarding the presence of causal neighborhood effects is to begin to articulate and empirically test different aspects of the specific processes thought to be involved (21, 33, 34). A large part of the research linking neighborhood environments to health has involved only rough approximations to the question, using crude proxies both for the relevant geographic areas (or neighborhoods) and for the area or neighborhood attributes that may be important (28, 33, 34). There has been little work on the actual processes and mechanisms that may link specific characteristics of neighborhoods to the health of the persons who reside in them (21, 33). Demonstrating that neighborhood environments are causally related to health will ultimately require showing that the purported processes through which neighborhoods could affect health are indeed operating. This implies moving from the general thesis that neighborhoods affect health to the specifics of how and why this may occur. Formulating what these processes may be and testing them empirically remains a challenge. Part of examining the processes requires specifying the type of persons and the specific health outcomes for which neighborhood environments are likely to be particularly important as well as identifying the characteristics of neighborhoods that are relevant. The paper by Balfour and Kaplan (14) is of special interest because it begins to move down this road in several ways.

Balfour and Kaplan focus on a particular subgroup of the population in which neighborhood effects would be expected to be especially important—the elderly. It has long been hypothesized that the elderly may be particularly vulnerable to the health-enhancing or health-damaging aspects of residential environments (35). They may be more likely than working-age adults to spend a large part of their daily lives in their neighborhoods. They may also be more likely than working adults to rely on neighborhood resources for services. Their daily activities, such as food shopping, food consumption, recreation, and social interactions, may often take place in the vicinity of their homes. Hence, both their exposure to neighborhood conditions and the degree to which those conditions are relevant to their health may be greater than they are for other age groups. One could therefore hypothesize that if neighborhoods are causally related to specific health outcomes, their effects may be especially strong in this age group. Following a similar reasoning, researchers examining the effects of neighborhood environments on child development have hypothesized (and confirmed) that the strength of neighborhood effects varies as children grow (36).

In addition, Balfour and Kaplan (14) focus on functional loss, an especially important health outcome in the elderly. Functional status is determined in part by the presence of limiting chronic diseases (37), which may themselves have been influenced by the neighborhood environments people have experienced over the course of their lifetimes (6, 38). More important, however, to the extent that functional loss is prevented or delayed by a physically and socially active life (39), it may be particularly responsive to the characteristics of the neighborhoods where elderly people live.

Living in deprived or problem neighborhoods may also have direct emotional consequences potentially related to functional loss (40, 41). Balfour and Kaplan investigate simple measures of neighborhood characteristics (traffic, noise, crime, trash and litter, lighting, and public transportation) that may be related to the likelihood that the elderly can be physically and socially active in their neighborhoods. They find that persons living in neighborhoods with multiple problems are at an especially high risk of functional loss, even after accounting for individual-level socioeconomic indicators and health status at baseline. As the authors note, the neighborhood characteristics they investigate are likely to capture general neighborhood quality, and the specific processes underlying the associations with functional loss remain to be fully determined. Nevertheless, the examination of these specific attributes is an important step forward compared with existing research that has relied largely on area socioeconomic indicators derived from censuses as proxies for the specific neighborhood characteristics that may be relevant (24, 28, 34).

An important critique of cross-sectional studies investigating contextual effects of neighborhood environments is that people may be selected into neighborhoods based on values of the outcome being investigated (30, 42, 43). The likelihood that this occurs depends, of course, on the extent to which the outcome in question influences where people can or choose to live. Skeptics could argue that persons with functional impairment may experience income loss, for example, and may be more likely to move to poorer neighborhoods, where the problems investigated by Balfour and Kaplan are more common. By using a longitudinal design, however, Balfour and Kaplan are able to show that neighborhood characteristics are related to incident functional loss and, moreover, that this relation persists after accounting for health status at baseline.

Like other researchers interested in neighborhood effects, in their analyses Balfour and Kaplan confront several complex issues. These issues include defining “neighborhoods” (or more generally, the geographic areas relevant to the outcome being studied) as well as measuring the area-level constructs of interest. They use data self-reported by participants on a series of problems in their neighborhoods. Allowing participants to self-define their neighborhood has the advantage that it does not rely on the artificial, administratively defined areas such as census tracts or block groups used as proxies for neighborhoods in much research (28, 34). The characteristics of what people perceive to be their neighborhood may be particularly relevant to the health outcome Balfour and Kaplan investigate. On the other hand, the characteristics of administrative areas (particularly if they are linked to area policies) may be relevant for other outcomes. The implications of using alternate neighborhood definitions for results regarding neighborhood effects on health have not been examined. The size and definition of the area that is relevant may differ for different outcomes, causal processes, social groups, and contexts (for example, in large urban vs. rural areas) (44).

Balfour and Kaplan (14) characterize neighborhoods based on each participant’s assessment of his or her neighborhood.

Other alternatives for characterizing neighborhoods include aggregating the results of neighborhood surveys (with multiple residents responding per neighborhood), the use of observers and standardized criteria, and databases with geographically linked information to estimate density and distance measures for area resources and services (45–47). The implications of using different measurement strategies or of using residents' subjective reports compared with objective measures of neighborhood environments are largely unknown. Perceived or subjective measures could potentially underestimate objective differences across neighborhoods. Alternatively, for some outcomes (and possibly for functional loss in the elderly), the perceived characteristics of neighborhoods may be the more relevant predictor. Interestingly, data in the paper by Balfour and Kaplan show that people living in more disadvantaged census tracts were more likely to report problems, suggesting that people's perceptions of their neighborhoods are grounded in reality. In general, however, the development of specific measures of the objective aspects of neighborhood environments hypothesized to be related to health is an important need in this field (48).

Epidemiologists have traditionally emphasized the triads of "agent, host, and environment" and "person, time, and place" as important in understanding the causes of ill health (49). However, modern epidemiology, with its emphasis on individual characteristics, has largely assumed that "places" can be ignored once individual factors are accounted for. Yet, in our daily lives, few would doubt the many benefits of living in a "good" as opposed to a "bad" neighborhood. Investigating how places are related to health will require learning to characterize places as well as we have learned to characterize the biology and behavior of people. It will also require bringing to bear information from qualitative research on how persons relate to, are affected by, and modify the places where they live. This information will help develop richer (and more realistic) hypotheses regarding the specific processes linking neighborhood environments to health that can later be tested using quantitative data. Determination of whether neighborhood environments are causally related to health is plagued by complexities, but so is the investigation of many (if not all) causal relations studied in health research.

Neighborhood differences are not "naturally" determined but rather result from social and economic processes influenced by specific policies. As such, they are eminently modifiable and susceptible to intervention. In addition, the improvement of neighborhood environments is likely to have a multitude of benefits for people and society as a whole. Today, however, it often appears that preventing disease through gene therapy and new drugs (with often unknown adverse effects) is easier, more rational, and even more feasible than implementing or changing social and economic policy. Further elucidating and documenting the relation between places and health (as Balfour and Kaplan do), as well as the links between policy and neighborhood differences, may contribute to a much-needed debate on priorities and strategies for health promotion and disease prevention.

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