

Active Living Research in Light of the TRB/IOM Report

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Most of the papers in this issue speak, one way or another, to the question of how physical activity is, or might be, related to the built environment. This question was at the heart of a recent National Research Council (NRC)^a study, which culminated in the report, *Does the Built Environment Influence Physical Activity?: Examining the Evidence*.¹ The study was motivated by deep concern, especially within the public health community, about the lack of sufficient participation in physical activity among Americans and by curiosity about the extent to which changes to the built environment might help to increase levels of activity. The NRC study highlighted the pressing need for research along several lines if the built environment-physical activity relationship is to be understood sufficiently well to know if and how changes in the built environment might effect large-enough changes in population-level physical activity to be worth the cost of making such changes. My goals in this brief commentary are first, to provide an overview of the NRC study and its recommendations and second, to assess the ways in which the papers in this issue help to close the research gaps that the NRC study identified.

The NRC Study

In 2002, the Robert Wood Johnson Foundation (RWJF) and the Centers for Disease Control and Prevention (CDC) requested the NRC to conduct a study on physical activity and the built environment. The NRC study process is well established within the National Academies. Following the formation of a committee of experts, a study committee deliberates and prepares a report summarizing its findings, conclusions, and recommendations. Reports are published only after an extensive review process. In their deliberations, committee members are instructed to separate fact from opinion and analysis from advocacy, to apply rigorous standards of evidence, and to reach consensus if possible.

In response to the request from the RWJF and CDC, the Transportation Research Board (TRB) and Institute of Medicine (IOM) formed the Committee on Physical Activity, Transportation, and Land Use, a committee of 14 experts

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drawn from the transportation, urban planning, and public health communities.^b The charge to the committee was to review broad trends affecting relationships among physical activity, transportation, and land use; to summarize what is known, including the strength and magnitude of any causal connections; to draw implications for policy; and to identify priorities for research. In the process of its deliberations the committee identified key issues, commissioned a paper on each, and held a workshop that focused on the commissioned papers. I should stress that the literature on physical activity and the built environment is relatively recent and is currently expanding at an extremely rapid pace; the committee had to bound the literature it reviewed and was not able to consider research contributions published after summer 2003. The committee did reach consensus and unanimously supports the findings, conclusions, and recommendations described in the report.^c Nine independent, anonymous reviewers reviewed the report, and the report was published only after the committee responded in writing to each of the reviewers' comments to the satisfaction of the NRC's Report Review Committee.

The committee's *findings* can be summarized as follows: The built environment can facilitate or constrain physical activity. The relationship is complex, however, and operates through many mediating variables, such as socio-economic characteristics, personal and cultural variables, safety and security in the built environment, and the individual's decisions about time allocation. Empirical evidence shows a linkage between the built environment and physical activity, but causality has not been established, strengths of the relationships are not known, and the characteristics of the built environment that are most closely associated with physical activity are unknown. Also unknown are how the relationship between the built environment and physical activity varies by location (e.g., urban, suburban, rural) or by population subgroup (defined, for example, by age, sex, race/ethnicity) or how important different characteristics of the built environment are to total daily physical activity. The current literature reflects the lack of sound theoretical frameworks to guide empirical research, inadequate research designs (e.g., most studies are cross-sectional whereas longitudinal studies are needed to assess causality), and incomplete data (e.g., national surveys on physical activity lack data on location, and national data on travel, which do record location, neglect physical activity).

Existing research cannot disentangle, for example, if the observed association between certain neighborhood characteristics (e.g., high population density, mixed land use, good sidewalks) and higher-than-average levels of walking reflect the effects of the built environment on physical activity or the residential preferences among people who enjoy walking which influence their decisions to live in such neighborhoods. The ability to answer this puzzle is important for policy: if the observed association between the built environment and physical activity is due to self-selection, then changes to the built environment, which can be very costly, are unlikely to yield the desired significant increase in physical activity. The committee did find, however, that because the built environment has been shaped by the policies and practices of many decision makers (including elected officials, traffic engineers, and developers) and because the built environment is constantly changing, many opportunities and places for potential intervention continually present themselves.

The committee's deliberations led it to the following *conclusions*: Because of the well-established relationship between physical activity and health, more

activity-friendly built environments are desirable. Although most studies to date have focused on the residential environment, opportunities to increase physical activity exist in many settings, including home, work, travel, and leisure, and the built environment has the potential to affect physical activity in each of these settings. Without more compelling evidence, however, the committee was not able to provide guidance on the cost-benefit ratios of specific investments or to provide assurance that such investments would lead to more physical activity.

Based on their findings and conclusions, the committee offered the following *recommendations*: In view of the current state of knowledge and the importance of physical activity to health, the first and most important recommendation is to carry out a continuing and well-supported research effort. In this sense, the research community is the primary audience for this report. As part of recognizing the acute need for research, the committee identified a number of research priorities. These include the need to develop more complete conceptual models to guide empirical research and the desirability of undertaking interdisciplinary and international collaborative research. In particular, the committee's own work, which spanned two years, convinced committee members of the potential benefits stemming from collaborations among researchers from the public health, transportation, and urban planning/ design fields. Another research priority is conducting longitudinal studies to address causality issues and especially employing research designs to control better for self-selection bias. Studies are needed that match specific characteristics of the built environment to different types of physical activity to assess the strength of the relationship among different population subgroups in particular spatial contexts. To inform policy, the knowledge base should tell us how strongly which aspects of the built environment are likely to affect which types of physical activity for which types of people in which types of geographic settings.

A recommendation that links to the committee's interest in seeing vastly increased research on this topic is to establish funding that would support a rapid response capability to study the physical activity effects of changes in the built environment as "natural quasi-experiments." The idea here would be to take advantage of on-going changes to the built environment, such as sidewalk or park improvements or the building of a bikeway or of an entire neo-traditional development, to conduct before and after studies to monitor the impacts of such changes. A related recommendation is for the study of the physical activity impacts of implementing social marketing strategies along with changes to the built environment: Can social marketing enhance the impacts of alterations to the built environment on physical activity?

The committee recommends expansion of national public health and travel surveys to make these widely available data sources amenable to studies of the relationship between physical activity and the built environment. For health surveys, meeting this recommendation will entail geo-coding the locations of activities and adding information on physical activity that is not associated with leisure; that is, physical activity undertaken on the job, as part of housework, or as a means of travel need to be added. For travel surveys, meeting this recommendation will entail collecting more systematic and complete information on walking and biking and on the activities undertaken at destinations. For both health and travel surveys, meeting this recommendation necessitates collecting more reliable and valid measures of the built environment.

Additional recommendations are:

- that the Department of Health and Human Services and the Department of Transportation should work collaboratively through an interagency working group to shape a research agenda and funding proposal to Congress,
- that federally supported research should be targeted to large-scale, multi-year projects,
- that universities should train researchers and practitioners with skills that span physical activity, public health, transportation, and urban planning, and
- that those responsible for changes to the built environment should facilitate access to, enhance the attractiveness of, and ensure the safety and security of places where people can be physically active.

This last recommendation reflects the committee's recognition that incremental changes to the built environment are continually being made in many places by many actors and that over time such incremental changes have the potential to create environments that facilitate rather than constrain physical activity.

Active Living Research

Clearly the research agenda outlined by the NRC committee is enormous, and no one set of papers in a single issue of a journal can hope to fill the gaps the committee has identified. Furthermore, the studies reported on in this issue were well underway long before the NRC report was made public in January 2005. Nevertheless, it is perhaps worth reflecting on the extent to which the papers here begin to address the research agenda described in the previous section; which items signaled in the agenda are under investigation in this set of papers, and which remain relatively neglected?

Topics Addressed

Almost all of the papers in this issue do address some component of the NRC report's research agenda, and those that do not, carry important messages for researchers (and publishers) in this field. In this group of papers, the agenda item paid the most attention is that concerning the need to develop valid and reliable measures of the built environment. These measurement-oriented papers pose a wide variety of questions, some of which relate the built environment measures to physical activity and others of which do not. The range of questions is instructive, for it suggests the breadth and vitality of the field at this moment. Questions focused solely on measures of the built environment include: What makes one street more walkable than another? (Ewing et al.);² What is the best way to design valid and reliable measures of community trails? (Troped et al.);³ What is the best way to measure the environmental aspects of parks and playgrounds? (Bedimo-Rung et al.; Saelens et al.);^{4,5} What are the steps for developing protocols for standardized GIS measures of the environment that are thought to be related to physical activity? (Forsyth et al.).⁶

Questions that relate measures of the built environment to physical activity include the following: How might objective observation be used effectively to relate levels of physical activity in community parks to park characteristics in Los Angeles? (McKenzie et al.);⁷ What is the relationship between neighborhood characteristics, including distance from home to school, and physical activity among sixth-grade girls? (Cohen et al.);⁸ What aspects of the built environment are related to walking for transportation and recreation purposes? (Lee and Vernez Moudon);⁹ What neighborhood characteristics, inter alia, explain levels of urban trail traffic? (Lindsey et al.);¹⁰ What characteristics of the neighborhood built environment are associated with walking enough to meet health recommendations? (Vernez Moudon et al.);¹¹ To what extent do community design and access to recreational facilities affect physical activity or body-mass index among children age 11 to 15 in San Diego? (Norman et al).¹²

Measures of the Urban Residential Built Environment

An interesting bifurcation in the studies here is between those for whom the “built environment” of interest is parks and trails versus those for whom the built environment is the urban fabric more broadly construed. Among the latter, Cohen et al. see the salient characteristics of the urban built environment as including street connectivity, block size, distance from home to school, and the socio-economic dimensions of neighborhood populations; to explore the impact of geographic scale, these authors measured neighborhood as the area within ½ mile of home, census block group, and census tract.⁸ They find that girls’ physical activity declines with increasing distance from school, but they point out that the causal factors giving rise to this finding remain unclear. Norman et al. also experiment with measuring aspects of the urban residential neighborhood at different scales, namely the area within 1 mi or ½ mi of home; they find that the 1 mi measures are more closely related to physical activity than are those for ½ mi.¹² The measures of the built environment used by Norman et al. are similar to those used by Cohen et al.—residential density, intersection density (a measure of connectivity), land use mix, number of recreation facilities, and the ratio of retail building floor area to parcel area. Norman et al. find that numbers of nearby recreation facilities and of parks were positively related to adolescent girls’ physical activity, whereas boys’ physical activity was positively associated with retail floor area.

Another study that uses measures of the urban fabric, the one by Lee and Vernez Moudon, focuses on land use types and intensities within 1 km (0.6 mi) of home as well as distance to closest destinations of various types (e.g., bank, school, grocery store, convenience store) up to 3 km from home.⁹ Lee and Vernez Moudon show that number of self-reported walking trips per week (ordinally scaled in the regression model) for *transportation* purposes is related to residential density and to having destinations like banks, food stores, and post offices nearby (as well as to being young, male, and married, inter alia) whereas number of walking trips for *recreation* purposes is related to length of sidewalks and average slope within 1 km of home and to residential density as well as to being female and having a dog, inter alia. The urban environmental characteristics that Ewing et al. focus on have to do with the physical features and urban design qualities of streetscapes.² Using a panel of experts and video clips, these authors find that the urban design

features of human scale, imageability, and enclosure are most strongly related to walkability as judged by the experts.

In general, the studies in this issue that examine the relationship between measures of the urban built environment such as density, street connectivity, and land use heterogeneity and measures of physical activity such as walking add appreciably to the existing knowledge base. Like the overwhelming majority of such studies in the literature, all such studies here are cross-sectional, and their authors acknowledge the inability to make causal inferences from their data. Also like the bulk of existing studies, studies here that relate measures of the urban fabric to physical activity create environmental variables that pertain to the residential neighborhood, to the neglect of the workplace. Nevertheless, insofar as their data sets verify these associations for different population groups living in different locations, the findings here add heft to the growing body of literature that finds associations between physical activity and certain characteristics of the built environment. It is interesting and important, for example, to know that in Seattle the built environment characteristics related to walking for transportation are not the same built environment characteristics related to walking for recreation (Lee and Vernez Moudon).⁹ It is also interesting and important to know that in San Diego different aspects of the built environment are related to the physical activity of adolescent girls compared to that of adolescent boys (Norman et al.).¹² Detailed empirical studies like these and others in this issue contribute significantly to understandings of which aspects of the built environment are related to which aspects of physical activity for which types of people.

An interesting aspect of the studies that entail measuring the *urban* built environment is that, as a group, they use buffers of varying size around the home (e.g., 1 mi, ½ mi, 1 km). The geographic scale at which measures of the built environment are calculated or are related to different kinds of physical activity is an understudied topic of considerable significance. In this issue, Cohen et al. and Norman et al. begin the important work of exploring the ways that geographic scale might affect the nature of observed relationships between the built environment and physical activity.^{8, 12}

Measures of Parks, Playgrounds, and Trails

Other authors interested in improving measures of the built environment focused on parks, playgrounds, and trails instead of the residential neighborhood. Several of these (Bedimo-Rung, et al., Saelens et al., Troped et al.)³⁻⁵ sought solely to devise valid and reliable techniques for measuring the environmental attributes of parks, playgrounds, or trails, without relating their measures to physical activity. Others did relate measures of the park or trail environment to physical activity (McKenzie et al.)⁷ or to a surrogate for physical activity (i.e., frequency of trail use (Lindsey et al.)).¹⁰ In general—and of necessity—these studies that focused on parks took a rather different approach to measuring the built environment; instead of creating a buffer around the residence and creating measures of the built environment within the buffer (e.g., sidewalk length, land use mix, block size), these studies used audits and survey instruments to design objective assessments of the presence/absence and quality of various park or trail characteristics. In their use of observer-based measures, these studies of parks and trails are akin to that of Ewing et al., which aimed to assess the walkability of urban streetscapes.

Having this group of studies (on measuring the characteristics of urban parks, playgrounds, and trails) together here in one issue begins to put such studies into conversation with each other and suggests the potential value of doing so. What are the relative advantages and disadvantages of using SOPARC (McKenzie et al.),⁷ PEAT (Troped et al.),³ EAPRS (Saelens et al.),⁵ or the BRAT-Direct Observation Instrument (Bedimo-Rung et al.)?⁴ No doubt answering this question will require seeing how well each of these and other measures of parks/trails performs as a predictor of physical activity; the real test of these measures will be their sensitivity to different levels of physical activity for different population groups.

Other papers in this issue (Lee and Vernez Moudon; Vernez Moudon et al.),^{9,11} which explored how aspects of the built environment are related to walking, raise the question of how important parks and trails are to physical activity: these authors report that neither distance to the closest park nor distance to the closest trail was related to walking behavior. The studies did not, however, include measures of park quality—only a measure of park proximity; perhaps future studies that incorporate the park-quality assessment techniques outlined in this issue by Saelens et al. or Bedimo-Rung et al. will demonstrate that indeed parks are significantly related to overall physical activity. Clearly a great deal more work remains to be done on the relationship of parks and trails to physical activity.

A Message to Publishers

Among the strengths of the empirical studies in this issue are the evident benefits of assembling interdisciplinary research teams and the care taken to evaluate findings in light of those of previous related studies. In addition, a number of authors provide frank discussions of the limitations of their studies and candid assessments of why the observed built environment-physical activity relationships were so weak. These kinds of assessments are crucially important to the advancement of the evidence base in this research arena. As Andreyeva and Sturm¹³ point out, editors and publishers tend to favor studies that yield statistically significant results, but this kind of publication bias has the insidious effect of undermining the construction of a solid knowledge base in a field—one that must necessarily benefit from incorporating “negative” results.

Conclusion

The studies in this issue address a number of the items in the research agenda outlined in the NRC report. In particular, many of the authors here are tackling the problem of how to devise valid and reliable measures of the built environment, and they are adding to the knowledge base concerning which aspects of the built environment are related to which types of physical activity among which population groups. These are valuable contributions. An important area that remains to be addressed concerns the question of causality: to what extent might changes in the built environment lead to increases in physical activity? This is the question that motivates Heath et al. to sift through the literature to find studies that identify urban design, land use, or transportation policies that, at least in cross-sectional study designs, seem to encourage population-level increases in physical activity.¹⁴ The excellent research agenda outlined at the end of their paper signals the

large amount of research needed before the causality question can be answered satisfactorily.

Taken together, the studies in this issue raise additional questions for the research agenda on physical activity and the built environment. One, for example, concerns how the measure of physical activity employed affects the strength of the observed relationship between the built environment and physical activity; for example, self-reported number of walking trips per week (Lee and Vernez Moudon)⁹ seems to be more strongly related to aspects of the built environment than is minutes per day of moderate to vigorous physical activity as measured via accelerometers (Norman et al.).¹² Another concerns the marginal contribution of variations in the built environment to levels of physical activity; Lindsey et al. and Norman et al., for example, report that the urban form variables in their studies explained very small amounts of variation in their physical activity measures.^{10, 12} Finally, the NRC report reminds researchers to keep their eyes on the “prize” of *total* daily physical activity: to what extent might changes in the built environment lead to increases in the total physical activity of individuals and groups?¹

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Notes:

^aThe National Research Council is the research arm of the National Academies of Sciences, which consists of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

^bThe committee members were Susan Hanson, Clark University (Chair); Bobbie A. Berkowitz, University of Washington, Seattle (Vice Chair); Barbara E. Ainsworth, San Diego State University; Steven N. Blair, Cooper Institute; Robert B. Cervero, University of California, Berkeley; Donald D.T. Chen, Smart Growth America; Randall Crane, University of California, Los Angeles; Mindy Thompson Fullilove, Columbia University; Genevieve Giuliano, University of Southern California; T. Keith Lawton, Metro, Portland, OR; Patricia Mokhtarian, University of California, Davis; Kenneth E. Powell, Georgia Department of Human Resources; Jane C. Stutts, University of North Carolina, Chapel Hill, and Richard P. Voith, Econsult Corporation. Nancy P. Humphrey of the Transportation Research Board staff was the Study Director.

^cIn describing the committee's findings, conclusions, and recommendations I use language that mimics or closely paraphrases the language in the report so as not to distort the issues on which the committee reached consensus.