



Sorting Out the Connections Between the Built Environment and Health: A Conceptual Framework for Navigating Pathways and Planning Healthy Cities

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ABSTRACT *The overarching goal of this article is to make explicit the multiple pathways through which the built environment may potentially affect health and well-being. The loss of close collaboration between urban planning and public health professionals that characterized the post-World War II era has limited the design and implementation of effective interventions and policies that might translate into improved health for urban populations. First, we present a conceptual model that developed out of previous research called Social Determinants of Health and Environmental Health Promotion. Second, we review empirical research from both the urban planning and public health literature regarding the health effects of housing and housing interventions. And third, we wrestle with key challenges in conducting sound scientific research on connections between the built environment and health, namely: (1) the necessity of dealing with the possible health consequences of myriad public and private sector activities; (2) the lack of valid and reliable indicators of the built environment to monitor the health effects of urban planning and policy decisions, especially with regard to land use mix; and (3) the growth of the “megalopolis” or “super urban region” that requires analysis of health effects across state lines and in circumscribed areas within multiple states. We contend that to plan for healthy cities, we need to reinvigorate the historic link between urban planning and public health, and thereby conduct informed science to better guide effective public policy.*

KEYWORDS *Urban planning, Public health, Population health, Urban health, Built environment, Land use, Transportation.*

While it has been stated before, it nonetheless bears repeating that the connections between urban planning and public health are not new.¹ What has changed is the magnitude of the population health crisis that we presently face in both the developed and less developed areas of the world. The United Nations Human Settlements Programme (UN-HABITAT) estimates that approximately 1 billion people out of a global population of close to 6 billion people are presently living in slumlike conditions.² By 2030, the global population is expected to increase by about 2 billion people; the slum-dwelling population is expected to account for half of this increase.² The squalid living conditions of industrialized cities in the middle of the 19th century that gave rise to both the urban planning and public health professions

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are again fully manifest at the beginning of the 21st century,³ as large segments of the world's population lack basic shelter and sanitation, especially in developing countries.²

Unfortunately, the loss of close collaboration between urban planning and public health professionals that characterized the post-World War II era has limited the design and implementation of effective interventions and policies that might translate into improved health for urban populations. While the theory that connects the built environment to health and well-being is intuitively plausible, we still have a long way to go in collecting sufficient empirical data to make convincing appeals for planning and policy changes by the weight of the evidence.

In the interest of reviving strategic collaborations between urban planning and public health professionals, next we outline three major aims for this article. First, we present a conceptual model that developed out of previous research conducted separately by colleagues at the University of Michigan⁴ and our group at Columbia University,³ which we then connected and built upon to construct a framework for "Social Determinants of Health and Environmental Health Promotion."⁵ Unlike other approaches in which the built environment is considered as background or context, our conceptual model specifically focuses on urban morphology and responds to Hebbert's conjectures about where the streets and buildings belong in the "new public health."^{6(p446)}

Second, we review empirical research from both the urban planning and public health literature regarding the health effects of housing and housing interventions, both to illustrate how connections between the built environment and health and well-being have been investigated to date, and to recommend strategies that may be useful in future scientific inquiry. An earlier article by Greenberg et al. found only minor overlap in a review of all articles and book reviews published between 1978 and 1990 in the *Journal of the American Planning Association* and the *American Journal of Public Health*.⁷ Since that time, the "new urbanism" has devoted rather more attention to the new public health than vice versa,⁶ but recent campaigns spearheaded by the National Center for Environmental Health of the Centers for Disease Control and Prevention⁸ and the National Institute of Environmental Health Sciences of the National Institutes of Health⁹ are helping to redirect the attention of public health researchers toward investigating the health outcomes of urban design choices and community revitalization projects. In September 2003, the *American Journal of Public Health*¹⁰ and the *American Journal of Health Promotion*¹¹ both published theme issues devoted to the built environment and health. The current issue of the *Journal of Urban Health* provides additional scientific and policy focus on these connections, with particular emphasis on the urban context.

Finally, we wrestle with key challenges in conducting sound scientific research on connections between the built environment and health, namely: (1) the necessity of dealing with the possible health consequences of myriad public and private sector activities, including those primarily concerned with commerce, housing, transportation, labor, energy, and education;¹² (2) the lack of valid and reliable indicators of the built environment to monitor the health effects of urban planning and policy decisions, especially with regard to land use mix;¹³ and (3) the growth of the "megapolis" or "super urban region" that requires analysis of health effects across state lines and in circumscribed areas within multiple states.¹⁴ While they are by no means panaceas, we suggest strategies for addressing each of these challenges, in order to advance the science of connections between the built environment and health, and better plan for healthy cities.

FOCUS ON URBAN ENVIRONMENTS AND POPULATIONS

More of us are urban dwellers than ever before. According to the 2000 census, nearly 80% of the approximately 280 million people counted in the United States live in metropolitan areas or, more correctly, *metropolitan statistical areas*, defined as urban agglomerations of 50,000 people or more.¹⁵ The largest of these is the New York consolidated metropolitan statistical area, which spreads out over four states (New York, New Jersey, Connecticut, and Pennsylvania) and contains over 21 million people. The US Bureau of the Census defines a *consolidated metropolitan statistical area* as an agglomeration of over 1 million people living in adjacent primary metropolitan statistical areas or metropolitan statistical areas that by local common agreement are effectively aggregated into one region.¹⁵

The importance of this observation rests upon its implications for the relevant spatial unit for analyzing data, as well as the “level” for intervention to improve population health. For instance, most of the environmental interventions conducted to date, such as ameliorating lead paint, have occurred at the neighborhood, site, and building levels. Increasingly, however, the most important environmental and population health interventions, such as decreasing emissions of greenhouse gases, will require collaboration at the national, regional, and even global levels.

A CONCEPTUAL FRAMEWORK FOR UNDERSTANDING THE CONNECTIONS BETWEEN THE BUILT ENVIRONMENT AND HEALTH

Our joint urban planning and public health framework is centrally concerned with the social, political, economic, and historical processes that generate the urban built environment.³ By the built environment, we mean that part of the physical environment made by people for people, including buildings, transportation systems, and open spaces. The remainder of the physical environment is the natural environment. None of the natural environment per se remains in cities, since even the parks and waterways have been created—or at least significantly modified—by people, and are therefore part of the built environment.¹⁶ Nonetheless, the natural environment is essential to all life, including urban dwellers. Thus, while we consider the natural environment to be a fundamental determinant of health and well-being (see Figure), in the context of our joint urban planning and public health framework it is background, while the built environment is foreground.

Mary Northridge recently collaborated with Amy Schulz, a University of Michigan sociologist, to delineate the various mechanisms and pathways through which social, political, and economic processes interface with the physical configurations of cities to affect the health and well-being of urban populations.⁵ The conceptual model we jointly devised is presented in Figure 1.

Figure 1 was adapted from a conceptual model for understanding racial disparities in health that was developed by Dr. Schulz and her colleagues at the University of Michigan,⁴ and draws upon a joint urban planning and public health framework for use in health impact assessment that our group at Columbia University previously introduced.³ The model posits that three domains—the natural environment (including topography, climate, and water supply), macrosocial factors (including historical conditions, political and economic orders, and human rights doctrines), and inequalities (including those related to the distribution of wealth, employment

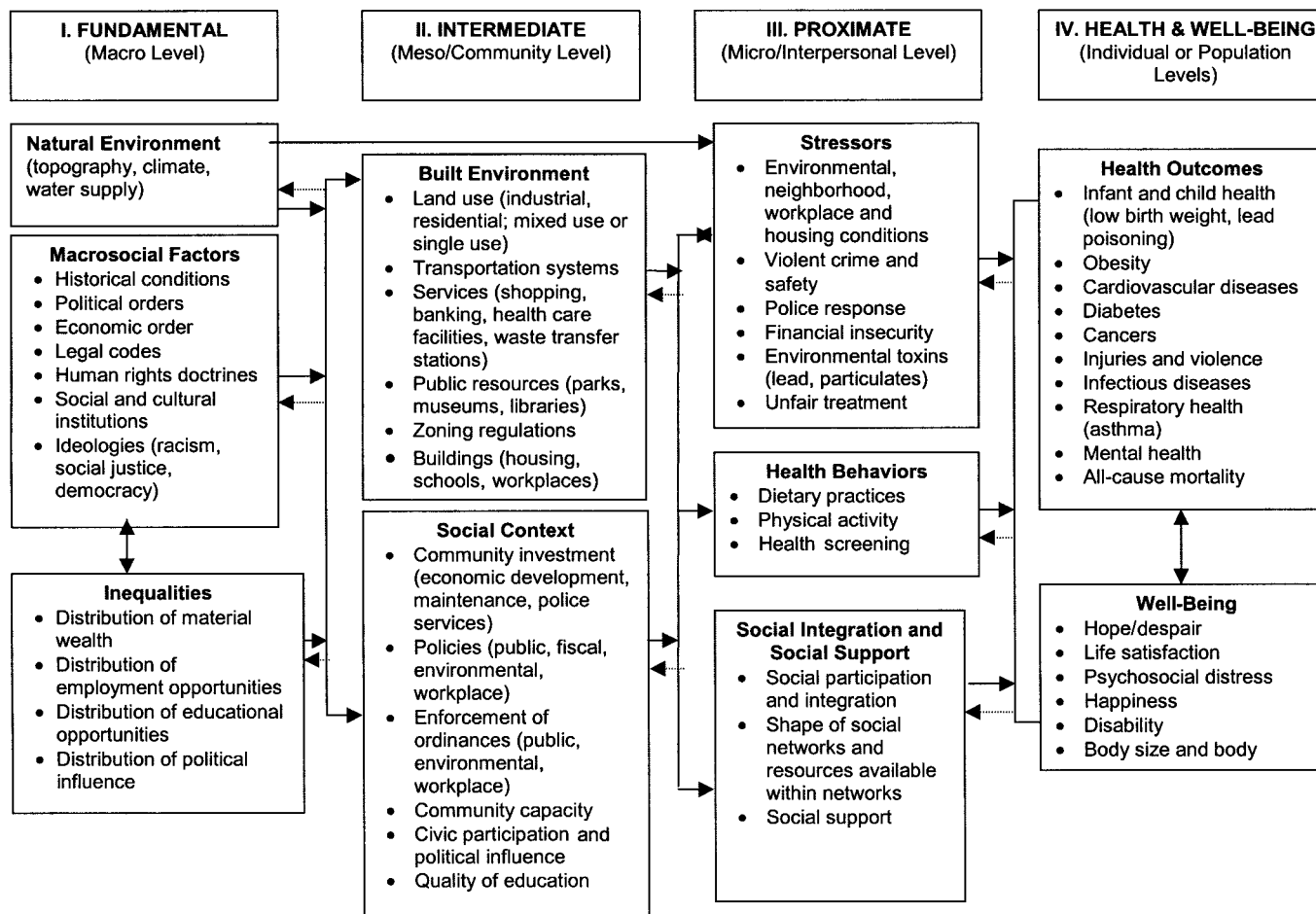


FIGURE 1. Social determinants of health and environmental health promotion. The model was developed for an article by AJ Schultz and ME Northridge.⁵

and educational opportunities, and political influence)—contain the fundamental factors that underlie and influence health and well-being via multiple pathways through differential access to power, information, and resources.¹⁷

Fundamental factors, in turn, influence two domains of intermediate factors: the built environment (including land use, transportation systems, and buildings) and the social context (including community investment, public and fiscal policies, and civic participation). Structurally, our model posits a set of simultaneous and dynamic relationships among four of the five domains that comprise the first two levels of our model. For analytic purposes, the natural environment is treated as an exogenous domain. It is important to note, however, that this last assumption does not hold over extended time frames. In the longer term, anthropomorphic choices about transportation systems and energy sources do, in fact, change the natural environment. Nonetheless, for our purposes, holding the natural environment relatively constant does little damage to more sophisticated models in which it, too, becomes an endogenous domain.

In terms of the synthesis we seek between the urban built environment and population health and well-being, it is the intermediate factors that we choose to emphasize, in particular. Whether purposefully or inadvertently, it is here that the impact of the built environment is especially subject to policy manipulation. A corollary is that these types of interventions may have the greatest potential benefit for improved population health and well-being. Intermediate factor interventions include the development of land use strategies based upon densification, land use mixing, and microscale design considerations. Because urban planners work at the interface between the built environment and social context applying the knowledge of social science and urban design to generate the physical configurations of cities, we believe that stronger collaborations between urban planners and public health practitioners may prove effective in designing and planning for healthy cities.

Moving from the intermediate factors to the proximate factors in Figure 1, we shift from the familiar territory of the urban planner to the familiar territory of the public health practitioner. The proximate factors influencing health and well-being are dominated by two domains: stressors (including violent crime, financial insecurity, and environmental toxins) and social integration and social support (including the shape of social networks and the resources available within networks). A somewhat transitional domain is depicted for health behaviors, as they are conceptually separate and distinct from the other two proximate domains, and yet are impossible to practically disentangle from them. Interactive and dynamic relationships among the various domains, between the fundamental and intermediate factors as well as between the intermediate and proximate factors, are depicted by the arrows in Figure 1.

In the past several decades, public health research and practice has focused on understanding and influencing health behaviors, such as smoking cessation, mammography screening, and consumption of more fruits and vegetables. As early as the 1970s and 1980s, however, economic insecurity—unemployment in particular—was implicated in the creation of both physical and mental illness.^{18,19} More recently, a broader set of proximate factors, including the effects of racism on health²⁰ and social support on longevity,²¹ have been given greater scientific attention.

Finally, the last column in Figure 1, Health and Well-Being, contains two domains: health outcomes include obesity, injury and violence, respiratory health, and others; well-being effects include hope/despair, life satisfaction, and happiness, to name but a few. As these in turn clearly influence civic life, Figure 1 illustrates the

interactive and dynamic nature of the proximate factors and health and well-being domains through the use of arrows between these levels.

Increased interest in the life course approach to chronic disease epidemiology has helped inform population health theory and practice over the past several years, even as this approach is not new to public health or unique to epidemiology.²² As defined by Ben-Shlomo and Kuh, the life course approach to chronic disease epidemiology is “the study of long-term effects on chronic disease risk of physical and social exposures during gestation, childhood, adolescence, young adulthood, and later adult life.”^{22(p285)} This perspective includes studies of the biological, behavioral, and psychosocial pathways that operate across an individual’s life course as well as across generations to influence the development of chronic diseases and is clearly consonant with the conceptual model presented in Figure 1.

EVIDENCE BASE FOR CONNECTIONS BETWEEN HOUSING AND HOUSING INTERVENTIONS AND HEALTH AND WELL-BEING

On October 25, 1967, at the engineering and sanitation section program at the 95th annual meeting of the American Public Health Association in Miami Beach, Florida, M. Allen Pond, Assistant Surgeon General for Special Projects of the Public Health Service, presented a paper on the role of the public health service in housing and urban life:

Health problems associated with housing—and the neighborhood that the housing services—are too important to be dealt with on a strictly categorical basis. The problems of the slums and the ghettos in America demand the broadest possible attention, and health officials at all levels must give the highest priority to their solution. The job to be done is simply too big to be handled in a unified, sharply delineated way. Indeed, much of what the Public Health Service does in support of research and development, preparation of standards, training of manpower, provision of technical assistance, and sharing in the costs of program development and operation bears significantly on our national efforts to improve the quality of housing and urban living.^{23(p101)}

Our interest in housing interventions is both long-standing²⁴ and contemporary,²⁵ renewed in part from ongoing efforts to address the childhood asthma epidemic in Harlem, New York City.²⁶ Presently, the shortage of affordable housing is so severe in New York City that the homeless population is larger than it has ever been at 38,200 people, including 17,000 children. Fully 85% of the homeless population in New York City is composed of families; 40% of these homeless children have asthma, and lack a regular physician or health care worker to oversee their medical care.²⁷

In searching the public health literature for research linking housing and health, we came across a comprehensive review of evidence related to the health and social effects of housing improvements.²⁸ Upon turning to the urban planning literature, we found an equally thoughtful review on both links between housing and health, and the effects of urban regeneration on health.²⁹ The following discussion draws heavily on these two current reviews.

Thomson et al. reviewed studies from the observational public health literature on hazards in domestic buildings and identified hygrothermal conditions, radon,

falls, house dust mites, environmental tobacco smoke, and fires as the major health risks.²⁸ Meanwhile, Curtis et al. reviewed studies from the urban planning literature and concluded that poor housing may affect physical health through greater risks of injury and violence, increased levels of respiratory disease and gastrointestinal problems associated with cold, damp conditions and mold growth, and increased rates of infection because of crowded living conditions, especially in temporary accommodations.²⁹

Nonetheless, Thomson et al.'s comprehensive review of the health effects of housing improvements concluded that there was insufficient evidence to support improved housing as a means to improved health.²⁸ In terms of general physical health and illness episodes, 10 of the studies reviewed found some health improvements, 5 studies found no differences on certain measures, and some studies found mixed effects. A more consistent pattern was found for mental health, suggesting that improved housing generates mental health gains. The findings on respiratory health were more equivocal, although one study found children's respiratory symptoms improved and fewer days were missed from school due to asthma 3 months after installation of central heating.³⁰

In terms of well-being, the intervention results were more positive. On the basis of four studies that assessed social outcomes, the overall findings were that, after relocation, residents reported a reduced sense of isolation, a reduced fear of crime, an increased sense of belonging and feelings of safety, increased involvement in community affairs, greater recognition of neighbors, and improved outlook on the area as a good place to live.²⁸ Conversely, two of the reviewed studies on rehousing and area regeneration highlighted the potential for unintended adverse effects because of increased rents. One older study reported increases in standardized mortality rates in the rehoused residents, which was attributed to a doubling in rents, and the household members' consequent inability to afford adequate food.³¹

Curtis et al.²⁹ concluded that it is difficult to disentangle the health effects of housing renewal from other factors. Housing improvements to windows and bathrooms, fencing of semiprivate spaces, closing alleyways, calming traffic, and improving children's play spaces in an English town estate resulted in reduced anxiety and depression, improved self-esteem, reduced fear of crime, and greater perceived "friendliness" of the area.³² In an area of Sweden that had undergone improvements to local services and facilities, the population showed reduced levels of mental illness and increased levels of social support.³³ Finally, Collard recorded the experiences of Bangladeshi families in temporary accommodations, who reported that financial assistance in moving, and redecorating and furnishing the home would have been helpful.³⁴ Not surprisingly, high levels of mobility had detrimental effects on the families' access to primary health care and education.

Saegert et al.³⁵ have reviewed and evaluated the key characteristics, methods, and results of housing interventions designed to improve health. Of the 64 interventions reviewed from 12 electronic databases, 90% addressed a single condition (most often lead, injury, or asthma), 59% were targeted to children, and 13% were designed for older adults. The message is that current interventions linking housing and health are woefully limited in both scope and scale. The lack of an evidence base relating improved housing to improved health may be due in part to the failure of public health researchers and practitioners to engage in meaningful housing development projects from the initial planning stages and to evaluate them longitudinally and across the life course using valid and reliable measures of health and well-being.

Calls for broad-based studies of the health impacts of the built environment and needed planning and policy interventions at the intermediate level in our conceptual model have historic precedent. On November 16, 1967, Richard A. Prindle, Assistant Surgeon General and director of the Bureau of Disease Prevention and Environmental Control, Public Health Service, gave a speech titled, "The City as Environment: Biological and Social Implications," at a centennial symposium at Wayne State University in Detroit, Michigan. He concluded:

We public health workers must begin to concern ourselves with land use policy in the broadest sense. We must develop criteria of effective use of resources, and in order to develop these criteria we must relate them to standards concerning the health and well-being of people.

We in the health professions also have a specific job of collecting the kind of information on which public planning and policy can be based and of translating these data for the decision makers—which ultimately is the general public. Finally, we in public health, in concert with others, must move from the ivory tower into the community to observe and work with situations as they exist. Epidemiology may not be the full answer, but it certainly is the beginning. We need measurements and plans based on those measurements. We need actions to correct the problems as those affected see them if our solutions are to be accepted, put in practice, and have lasting benefits.³⁶

This is not to say it will be easy. We turn our attention next to two key hurdles we have identified in conducting sound scientific research on connections between the built environment and health, and our proposed strategies for surmounting them.

CHALLENGES IN CONDUCTING SOUND SCIENTIFIC RESEARCH ON THE BUILT ENVIRONMENT AND HEALTH

Rather than compiling an exhaustive list of the challenges likely to be encountered in conducting research on connections between the built environment and health, we have elected instead to discuss two key areas and how we have sought to address each of the difficulties we faced. The first is the lack of valid and reliable indicators of the built environment to monitor effects of urban planning and policy decisions, especially with regard to land use mix. For instance, current land use policies not only facilitate automobile use and dependence but also actually hinder the ability to safely access even nearby urban destinations on foot or bike, or by mass transit. Prior to the establishment of a precedent for exclusionary zoning in 1926 (*Euclid, Ohio v Ambler Realty*), land uses were most often intermixed. Afterward, *euclidean* emerged as a euphemism to convey homogeneous zoning, which predominates in the United States today.¹³

Mixed use or heterogeneous zoning allows compatible but different land uses to locate in close proximity to one another and thereby decreases the travel distances between activities.³⁷ The effects of land use mix on travel choices vary as distances between complementary land uses increase. Thus, one strategy for mitigating air quality and traffic problems and encouraging walking, biking, and transit is to improve accessibility to work sites, services, and transit stations within existing urban settings.³⁸

Empirical research regarding the relationship between land use mix and travel behavior has been limited by the relative complexity of measurement, thereby ham-

pering investigations of proposed theoretical ideas involving population health effects.¹³ For instance, if a zone is more than half a mile across, then the benefit of mixing uses at a scale in which residents may choose to walk for shopping or a meal may not be captured. For this reason, measuring land use mix at the census block group level rather than at the census tract level may be more meaningful. In addition, when measured at a zonal level, land use mix also needs to take into account the effects of complementary land uses located in adjacent zones, since people do not recognize census borders when selecting destinations. If services are located within a convenient and pleasurable walk, that is, a safe and comfortable one, more people will access these services on foot rather than in automobiles.

Other methodological complications arise in examining the effects of land use mix on transportation modes. For instance, to reduce automobile use, there needs to be pedestrian connectivity between nearby, complementary land uses. Handy notes that access is a function of both travel times and the number and quality of nearby destinations, which need to be accounted for in empirical investigations.³⁹

As important as land use mix is to urban planning, there is a dearth of empirical evidence in the public health literature regarding the effects of zoning and land use policies that may potentially affect population health and well-being. An exception is Maantay's longitudinal case study of New York City over the period 1961 to 1998, in which she found that noxious industrial uses are increasingly concentrated within poor communities of color.⁴⁰ Employing geographical information systems along with block-by-block canvassing for walkability and verification of service locations, it may be possible to generate improved measures of land use mix across a range of urban and suburban communities that may be usefully employed in future investigations of connections between land use mix and population health.

A second major challenge in conducting sound research on the built environment and health relates to the growth of the megalopolis or super urban region, which requires the analysis of health effects across state lines and in circumscribed areas within multiple states.¹⁴ Not only is the United States a metropolitan nation, it is highly skewed in its distribution of residents. The 10 largest consolidated metropolitan statistical areas account for one third of the entire population. Hence, to effectively plan for urban design and health services, regional analyses are required.

The methodologies for conducting the necessary empirical investigations far surpass the cooperative arrangements that would be needed to implement meaningful policy interventions such as interstate compacts in state and local taxing and land use policy. For example, Rodwin and Gusmano, as part of their World Cities Project, first defined an urban core for New York City, London, Paris, and Tokyo, and then examined the similarities and differences among them.⁴¹ Their current studies illuminate inequalities in health care use and health status, the importance of neighborhoods in protecting population health, and the quality of life in diverse urban communities. Nelson et al., using data from the Behavioral Risk Factor Surveillance System, found significant intrastate differences for binge drinking among metropolitan areas in New York, Tennessee, and Utah.⁴² They concluded that metropolitan area estimates might be useful in guiding local efforts to reduce binge drinking. Such methods could be extended to investigate, for example, injury, diabetes, and obesity estimates by metropolitan area, and might then be related to transportation systems, land use policies, and other features of the built environment that have been calculated for these metropolitan statistical areas.¹⁴

Given sufficient resources, it may even be possible to conduct public health surveillance by city and "megacity," in addition to the current monitoring conducted by states. Certainly the methodological capabilities exist, including using

census blocks, census block groups, and census tracts, to construct meaningful agglomerations of the areas of interest.⁴³

EFFECTING MEANINGFUL CHANGE

When asked if he ever gets discouraged in his efforts to address urban poverty, Robert M. Coard, the president of Action for Boston Community Development, replied: “[Y]ou know that there’s a need. But the need changes. And the face of poverty changes. And what we do changes.”^{44(p4)}

The needs of the world’s poor are profound. The 21st century began with almost 2 billion people living in urbanized regions of the developing world, three quarters of whom live in wretched poverty. Over the next 30 years, the number of city dwellers will double to 4 billion, in a global population that by then will total 8 billion.³

According to de la Barra, “Cities are the physical expression of the societies that build them, and the political, social, and economic interactions of their inhabitants.”^{45(p7)} If we are to collectively revive a passion for “urbanism as a way of life”⁴⁶ in the 21st century, it is essential to pay careful attention to the physical definitions of streets and buildings, and ensure that public spaces are places of shared use.

One method of translating research into action on the built environment and health may be through some form of health impact assessment, which is expressly designed to deal with the population health effects of myriad public and private activities, including those primarily concerned with commerce, housing, transportation, labor, energy, and education.¹² In August 2002, Mary Northridge and Elliott Sclar attended a small working meeting of 25 scholars and practitioners from over eight disciplines and 10 countries at the Harvard School of Public Health in Boston, Massachusetts. The aim was to foster a critical exchange about the promises, process, and pitfalls of health impact assessment. In recognition of the fact that public health is strongly influenced by nonmedical health determinants, recent government policies in the United Kingdom and Canada, especially, have provided the impetus for conducting health impact assessments on policies that have not been traditionally viewed as the responsibility of the health sector.⁴⁷

While considerable caution was voiced at the meeting about institutionalizing health impact assessment in the United States, much was learned from the informed and engaged dialogue and debate. A greater appreciation on the part of urban planners and public health professionals of the political processes (from local to federal) that ultimately determine what policies are enacted and what projects are constructed is a first step toward ensuring that research on the built environment and health is more usefully directed toward planning for healthy cities. Yet scientific and professional input is not sufficient to promote healthy living conditions at increasingly high levels of density—the essence of urban life.³ Only by including the views of the people who bear the brunt of enacted policies and programs will any devised strategies prove acceptable and thus capable of improving population health and well-being. Methodologically, health impact assessment has the potential to improve diverse approaches to developing, testing, validating, implementing, and disseminating research on policies that affect population health, including but not limited to community-based participatory action research.^{12,48}

Ultimately, rather than institutionalize health impact assessment in the United States, it may eventually be possible to revamp the environmental impact statement process,⁴⁹ which has not been amended in 30 years. Concerns on the part of both environmentalists and developers regarding either erosions of current requirements

or further impediments to building projects have hampered efforts to restore it as a meaningful tool of land use decision making.¹ Such improvements might include stronger consideration of environmental health impacts on human populations, consequential public input from the start rather than only at the end of the process via litigation, and follow-up assessments of the predictions of environmental impact statements which rarely, if ever, are conducted.¹²

CONCLUSION

The conceptual model presented here, Social Determinants of Health and Environmental Health Promotion, includes both the built environment and the social context as intermediate determinants of health and well-being. We seek to integrate this model with other multilevel frameworks, notably the ecosocial perspective,⁵⁰ in addition to various complementary and reinforcing frameworks, including the life course approach,²² health and human rights,⁵¹ the precautionary principle,⁵² and sustainable production.⁵³ In order to meaningfully sort out the connections between the built environment and health, however, we need to do more than be explicit about the hypothesized pathways. We also need to test our theories empirically and use these data to refine our models.

The current public health literature lacks concrete measures of the physical dimensions of the neighborhoods and communities it purports to study. The current urban planning literature fails to take into account the distribution of health determinants within and across social groups defined by age, gender, race/ethnicity, class, and sexuality. We contend that in order to plan effectively for healthy cities, we need to reinvigorate the historic collaborative link between urban planning and public health professionals, and together conduct informed science. Perhaps then we can amass sufficient empirical data to make convincing “weight of the evidence” appeals for essential planning and policy changes to improve the health and lives of urban populations.

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