

The Built Environment and Public Health

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Abstract

The need for research relating micro and macro aspects of housing to human health is presented. The macro scale would link land use and planning with lifestyle and hence human health. An important link being discussed is the connection between exercise as influenced by housing area design and exercise and its subsequent impact on health. On the micro scale, a research agenda relating indoor air quality as influenced by housing construction materials and methods to human health is suggested.

Keywords: Health, Sprawl, Air, Quality, Built

Introduction

Recently researchers have made a strong case for a relationship between the built environment (those living and working edifices planned, designed, and constructed by humans) and human health. For example, a large conference was held in Singapore in December 2003 (ISIAQ, 2003) on energy-efficient healthy buildings. The topics varied from how land and urban development might make houses healthier to detailed analyses of chemical pollutants of indoor organic acids by solid phase microextraction analyzed with gas chromatography/mass spectrometry (SPME-GC/MS). The American Public Health Association, Inc. devoted the September 2003 issue to the relationship between the built environment and health. While we have known that indoor environments can have negative impact on health because of pathogens (Legionnaires' disease (legionellosis) was named in 1976 [CDC, (1)] because of an outbreak of the disease at a convention of the American Legion in Philadelphia.), chemicals, or particulates, we have only recently begun to recognize the connection between urban sprawl and obesity, for example. To quote Dr. Richard Jackson (Jackson, 2003), "Virtually everything in our build environment is the way it is because someone designed it that way . We now realize that how we design the build environment may hold tremendous potential for addressing many of the nations' greatest current public health concerns, including obesity, cardiovascular disease, diabetes, asthma, injury, depression, violence, and social injustice." He goes on to say it is time for a shift to communities intentionally designed to facilitate physical and mental well-being, and that the first step is to understand better the elements of the build environments that promote health.

It would appear to me that we have research opportunities on both ends of the scale of the built environment. On the macro end, we need to recognize the planning end of the planning, design, and construction process, and consider how it impacts human lives. (That is not to ignore the impact of sprawl on wildlife and how that impacts human lives. For example, a leading cause of

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automobile accidents in Michigan is collision with deer. It can be argued that ecosystem fragmentation due to sprawl is a significant cause of the collisions.)

We have designed our lives and our environment around convenience and automobile transportation without due consideration to the impact on our health. The move to suburbs has contributed significantly to a more sedentary lifestyle. One effect of sprawl has been to increase dependence upon automobile transportation at the expense of physical activity. Frumkin (2002) makes the argument that sprawl as measured by low residential density and low employment density along with other factors is associated with less walking and bicycling and more automobile travel. There has been an associated increase in human body mass index trending to obesity, and obesity is at an all-time high in the United States. There is a clear need for further research into understanding the association between sprawl and physical inactivity. I can personalize the design problem when I think of the subdivisions in which I have lived where there were no sidewalks on which to walk and it was unsafe to ride bicycles on the roads due to traffic intensity. Frumkin, (2002) lists 179 references in leading to his conclusion that there are eight considerations in the relationship between sprawl and health: air pollution, heat, physical activity patterns, motor vehicle crashes, pedestrian injuries and fatalities, water quality and quantity, mental, and social capital. Efforts are underway to improve pedestrian facilities, preserve green space, and upgrade public transportation.

On the micro end of the scale, we need to better understand the indoor environment in which we live. It would not surprise me to know that we better understand the relationship between the environment and well-being of an animal than we do for humans. We know with some degree of certainty the impact of ventilation, waste disposal, occupancy size, and diet of swine on their comfort, level of stress, and productivity. We could tell you the concentration of volatile organic compounds (VOC's) as measured with SPME-GC/MS in the facilities and how the concentration is impacted by ozone. And, we could tell you if there is a correlation between performance and concentration of VOC's. I don't think we can say the same for the human environment. Ruhl-Svendsen and Glastrup (2002) have conducted research in museums using SPME-GC/MS to determine the concentration of acetic and formic acid. Others such as Alexanderson (2003) have looked at emissions from adhesives and floor coverings and Salthammer et al (2003) have investigated concentrations of primary and reaction compounds from oriented strand board (OSB). Won et al (2003) developed an emission database for materials commonly used in housing that could serve as a starting point.

Current State of the Art

The state of the art on the macro scale is summarized in a white paper recently presented at a conference at Michigan State University (December 2003). This paper on programmatic thrusts and component research, outreach and education projects was presented by the Kellogg Land Polity Group. This white paper captures the state of the art and the need for health related research. Associated with that group is the Center for Global Change and Earth Observations.

The group, which has extensive experience and capability in characterizing land use, presented the following agenda relative to the Built Environment and Physical Health. (MSU, 2003).

1. Healthy schools project (linking community characteristics to school performance)
2. Walking to School: A Stratified Study
3. Likely consequences for new life-extending and enhancing medical technologies on human settlement patterns.
4. Characteristics of obesity and other exercise related ailments (socioeconomic, demographic, and community)
5. Relationships between land use and obesity, osteoporosis, and other diet and exercise related problems.
6. Investigation of Housing Choices and Neighborhood Preference of Walkers.
7. The Correlation between Obesity and Recreational Opportunities in Michigan's Urban Areas.
8. Indicators of quality of life, sprawl, quality education, and growth management.
9. Analyses of the incidence of school walk ability (including determinants and benefits).
10. Analysis of infrastructure needed for healthy communities.

The relationships and correlations described above can and should be determined. The white paper went on to describe other programmatic thrust areas including enhanced planning, coordination, and decision making in land use and data collection, information and analysis for improving land use policy.

On the micro scale, technological developments are enabling collection of data relative to indoor air quality more systematic and reliable. USEPA (USEPA, (1),2003) published a sampling method for indoor air volatile organic compound (VOC) sampling and analysis requirements (USEPA (2), 2003). Method T0-15 details the determination of volatile organic compounds in air collected in specially prepared canister and analyzing by gas chromatography/mass spectrometry (GC/MS). More recently, researchers have refined a method for GC/MS analysis known as solid phase microextraction or SPME. Koziel and Pawliszyn (2001) refined methods used by Ng et al (1996). Kim-Yang et al (2001) and Kim-Yang (2002) compared several methods for measuring indoor air odorants using GC/MS and found SPME to be the most versatile. The SPME GC/MS method has been refined and tested enough to be accepted as a reliable method of determining key air contaminants, and it is much simpler and faster than earlier used adsorption/desorption methods.

Future Research Directions

This is a call for research on the two ends of the built environment/health spectrum. We need to vigorously pursue a research agenda on the macro scale as summarized in the MSU Land Use Initiative. Perhaps the most accessible agenda item is that which delves into the relationship between land use and obesity. The land use data is available on the scale necessary to conduct meaningful research, but the obesity data is not. However, it can be obtained.

My interests lie in the micro scale. The techniques for characterizing indoor air quality are much more advanced than are the connections with the contaminant and health. I am defining a multi-disciplinary program of unknown but assumed high complexity. Nonetheless, it is an issue which will confront the housing industry and one which must be addressed.

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