Health and Environment in the Context of Urbanization*

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Abstract

This paper introduces a series of research projects designed to fulfill the societal role of environmental health studies by investigating (1) the dynamic and complex relationships between environmental conditions and (2) health in an urban setting. Research in this first category has revealed the existence of the combined influence of multiple physical environmental factors on health and its mechanisms. In the second category, there have been a number of studies of the integrated influence of social environmental factors on health employing an aggregate modeling of multiple determinants of health and studies of individual topics related to social determinants of health. These research projects have contributed to the formulation of specific remedies and the development of comprehensive health policies. Participatory approaches have been used to enhance capacity building opportunities and to ensure that research results reflect the actual conditions in urban societies. Healthy Cities projects and programs have been developed in close collaboration with this type of research. Urban societies have become interdependent and share the same issues globally. Further research into the relationships between health and the environment in the context of urbanization will expand the base of evidence applicable to the complex realities in modern societies.

Key words: multiple factors, physical environment, social environment, participatory-style research, Healthy Cities

Introduction

Research on environmental health and hygiene, as well as other aspects of social medicine, often reflect the health issues facing society at any given time; therefore, the research interests of individual researchers are influenced by their environment. This paper focuses on the author's research from the broad perspective of hygiene to protect health, in the hope of generating shared interest in this subject. This report will also present a summary of a series of research projects attempting to fulfill the societal role of environmental health studies by investigating the dynamic and complex relationships between environmental conditions and health in an urban setting (1, 2).

Studies of the environment consider many aspects, which classic textbooks group into physical, chemical, and biological

factors on the one hand, and socioeconomic and cultural factors on the other. Citizens' health is likely affected by a wide variety of compounds and multicausal factors. From the viewpoint of social medicine, the influence of these environmental factors is important to understand the forces that give rise to health disparities. In addition to characterizing these forces, it is necessary for researchers to determine methods of eliminating such disparities. In general, social medicine responds to the demands of the time, which also place their own limits and constraints; from a scientific standpoint, this has sometimes been pointed out as one of its weaknesses. This paper reflects social issues in Japan's postwar history and Japan's experiences in rapid industrialization, high-rate economic growth, the development of a highly urbanized society, technological innovations, and globalization.

The following sections introduce research efforts to examine the combined influence of multiple physical environmental factors and the integrated influence of multiple social environmental factors on health and discuss future prospects for research in the field of social medicine.

Combined Influence of Multiple Physical Environmental Factors on Health

In considering citizens' health in the context of the reali-

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ties of urban life, it is necessary to identify the various influences and interactions among environmental factors. However, because innumerable individual factors are involved and treating them in aggregate is difficult, research must focus on certain chemical compounds and physical environmental factors as illustrative examples.

According to the large number of organic solvents used in small businesses in the traditional downtown *Shitamachi* area of Tokyo and the potential adverse health influence of such solvents, studies of the influence of chemical compounds on human health have placed special emphasis on revealing the mechanisms of organic solvents metabolisms (3, 4). By considering the lifestyle patterns of workers and laborers who handle organic solvents, the combined influence of selected organic solvents and specific lifestyle conditions has received attention. Studies of the combined influence of poor nutritional status, exposure to organic solvents and alcohol consumption show some examples of these combined effects (5, 6). Other factors that have been analyzed include air pollution and low temperatures (7), carbon monoxide from antiquated home heating sources (8, 9), cold stress (10, 11), smoking (12), and food additives in the diet (13, 14).

There are many options in terms of which responses to evaluate in determining the influence of factors *in vivo*. Simple protocol in experiments to use death of animals by exposure to certain chemical compounds or environmental conditions as an indicator of evaluation is problematic in terms of making realistic extrapolations. Therefore, it was necessary to develop other, more satisfying experimental protocols for these studies. The satisfying protocol should determine the interactions of factors with different loci of activity as a basis for indicating the possibility of unanticipated multiple influences in an actual social context, and should be able to monitor observable effects in real time to enhance the explanatory power of the conclusions. Thus, evaluative systems employing perfused organs, including the kidney (15), liver (16), and heart (17), have been introduced to evaluate the multiple influences of environmental chemical substances. To demonstrate the effects of influences in multiple loci, the underlying mechanism of metabolism and its interactions with various factors must be elucidated. For detailed mechanisms, simpler supplementary experimental protocols have also been employed (18, 19).

With regard to the exposure-effect relationship, the studies referenced above indicated that various types of multiple influences can be determined depending on which phenomena were selected for evaluation. Moreover, it was demonstrated that interactions among environmental factors are possible even at the level of simple environmental load, prior to the onset of illness or other manifestations of health effects.

Integrated Influence of Social Environmental Factors on Health

Cities usually face issues with negative aspects associated with ill health problems. These problems are closely related to environmental factors, particularly social and socioeconomic environmental factors, among which there are multiple complex correlations. Approaches to address these issues cannot stop at

the mere presentation of the facts: they must lead to proposals that can lead to the development of realistic policy responses. The following two approaches have been taken: research based on the aggregate modeling of correlated factors, and research on individual topics exemplifying parts of the chain of multiple factors.

Research using aggregate modeling has demonstrated broad connections among aggregated social factors, which provided a research model indicating the dynamic relationship between health and environmental indices, first in preliminary studies (20), leading to the proposal of a fully realized model (Fig. 1) (21), which has now been applied to studies of mortality and urban indicators in Shanghai as well as studies of health indicators and socioeconomic factors in cities in Japan (22, 23).

Individual research topics have been studied against a background of complex environmental factors, including homelessness (24), alcohol-related issues (25, 26), issues of remaining of densely-housed areas with old wooden buildings (27, 28), the problems relating to personal skills among people from disadvantaged educational backgrounds regarding the use of emergency ambulance services and the acquisition of information for health promotion (29, 30), health education aimed at overcoming the digital divide (31), and regional experiments with the technological application of equipment (32, 33). These are important topics from the standpoint of social medicine in terms of addressing contemporary urban problems.

An environmental health approach taking the above-mentioned social environmental factors into account confirmed that people under disadvantaged socioeconomic conditions tend to reside in disadvantageous physical, chemical, and biological environments, and that environmental improvement or environmental adaptation requires personal skills, the social safety net, and related issues to be addressed in a systematic manner.

Future Prospects of Social Medicine Research

In the field of social medicine, in addition to research to obtain broad-based scientific evidence, studies using problem-solving approaches are also important. The policy-inducing solutions must be developed by reflecting research results. However, such research geared directly toward actual social change has not evolved into a major research theme. The findings of recent studies have indicated that a broad range of environmental factors have an impact on the health of our citizens, bringing about various health disparities among the different parts of society. From the perspective of social medicine, research projects have contributed to the development of techniques that utilize research activities in the formulation of specific remedies and to the development of comprehensive health policies. With regard to the former, participatory approaches to research and education have been encouraged, and with regard to the latter, Healthy Cities projects and programs have been developed in close association with the development of research work in this area.

Participatory approaches to research and education are more evolved forms of participatory-style research. In addition to encouraging the active participation of those involved, such approaches provide educational opportunities during the course

Fig. 1 Inter-relationships between health determinants and health status. ‘Health status’ is represented by the health index. ‘Healthcare resources’, ‘Preventive activities’, ‘Environmental quality’, ‘Housing’, ‘Urban clutter’, ‘Education’, ‘Employment’, ‘Income’, ‘Local economy’ individually represent health-determining factors. Fine thread arrows indicate pairs of health-determining indices with a statistically significant correlation with Pearson correlation coefficients. Thick thread arrows show the relationship between health determinant indices and the index of health with Pearson correlation coefficients. [Source: Takano T, Nakamura K: An analysis of health levels and various indicators of urban environments for Healthy Cities projects. *J Epidemiol Community Health*. 2001;55:263–270.]

Fig. 2 The role of social medicine research in featuring policies for healthy urbanization.

of the research project. Several pilot studies (34–36) involving field research have been conducted in various Asian cities. The Healthy Cities projects and programs, endorsed by the World Health Organization, are parts of a comprehensive scheme for promoting health and local development through policy processes based on intersectoral collaboration and community participation (37, 38). The implementation of these programs requires a common awareness of the present conditions, consensus building, decision making, and the participation of a broad segment of the public. For these programs to be successful, it is essential to ensure that the issues involved are plainly obvious. Visualization of scientific results in a readily understandable forms (39, 40) and carrying out a complex discussion of social costs, financial adjustment policies and health in an easily comprehensible manner (41, 42), both of which require further research.

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