

# Healthy City Science and Planning Evidence-Based Practice

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**Abstract :** Healthy city is one of the ideal models and important development paradigms of cities. Defined the concepts of "healthy urban science" and "healthy urban planning" and their key scientific issues, established a "health risk-resource-behavior" spatial intervention gradient theoretical model, and clarified the path and core of integrating health into multi-scale and multi-type spatial planning. Key points are proposed, and the evidence-based practical work flow of "diagnosis-preparation-evaluation" for healthy urban planning is proposed. On this basis, a scientific future framework for healthy cities in which the "cognition sector" and the "intervention sector" promote each other is constructed, and the deepening direction of the two sectors is clarified. Finally, it is proposed that we should vigorously promote interdisciplinary integration innovation with planning as the core, multiple types of cutting-edge practices with health as the focus, and full-chain talent training with interdisciplinary orientation; establish a sustainable "healthy city science and planning" industry-university-research institute Linked systems, moving towards a healthier future for humans and the planet.

**Keywords :** healthy city; evidence-based practice; interdisciplinary; industry-university-research linkage

Urban and rural space is the main carrier of human activities, which directly or indirectly affects people's physical and mental health through complex paths. "Healthy city planning" regulates and shapes space based on reducing health risks, optimizing health resources, and promoting healthy behaviors. It is an important policy tool to achieve health promotion and disease prevention and control, and plays an important role in "preventing disease" at the population level. [1]. Urban planning originated from the need to improve public health and health conditions. It puts forward basic requirements for public health from a spatial perspective (sunlight, ventilation, isolation of pollution points, etc.). Healthy urban planning is a return to disciplines and industries [2-3]. Currently, new health challenges are emerging, such as obesity, chronic non-communicable diseases (such as cardiovascular diseases), psychological and cognitive diseases (such as depression, Alzheimer's disease), and new infectious diseases. Complex health problems are related to rapid There are contradictions between the growing health needs, and "how to control space at the source of planning and design to achieve population physical and mental health intervention" has become an important issue. Incorporating public health considerations into planning and design has become an important part of improving the quality of urban space in a "people-oriented" manner [4-6].

In this context, this article proposes to promote and build "healthy city science" to support the advancement of healthy city planning. Plan for health. Healthy city science is a research goal that promotes spatial health throughout the human life cycle. It is based on

multidisciplinary theories and knowledge systems, covers macro to micro multi-dimensional spaces, and explores the long- and short-term impact mechanisms of urban development on health and well-being. science. The key scientific issue is how to measure the short-term and cumulative effects of urban and rural spatial elements on physical and mental health. We need to fully consider the integration of health in the construction of the current planning system [7]; carry out evidence-based practices based on healthy city science and build a future development framework for healthy city science. This article discusses the path and technical process of integrating health into spatial planning, clarifies new knowledge points and education methods, and builds an industry-university-research linkage system of "Healthy City Science and Planning".

### 1 Theoretical Model of Healthy City Planning

Integrating health into the spatial planning system requires clarifying the mechanism of spatial intervention in health, that is, what spatial elements are regulated by planning and on what path it affects physical and mental health, which is also the core of healthy city science. There are some theoretical models [8-10] that link spatial elements with health, such as the environmental health rainbow mechanism diagram, the impact path diagram of urban and transportation planning on health and well-being, the causal relationship diagram between the built environment and chronic diseases, etc., but these theories The model fails to closely connect spatial planning indicators and is difficult to guide healthy integration into the spatial planning system. In response to this problem, the author proposed the "four elements and three paths" theoretical model of spatial planning affecting health in the annual academic works "Quality Planning (2016)" and "National Healthy Cities Blue Book (2019)" of the China Urban Planning Society [1, 11]. In this model, the four types of spatial elements that can be controlled by planning are land use, spatial form, road traffic, green space and public open space. Relevant empirical research can measure the specific planning indicators of these elements and clarify their significance and thresholds. Three pathways include reducing sources of pollution and their risk of human exposure (health risks), providing accessible health facilities (health resources), and promoting physical activity and interaction (health behaviors). This theoretical model was incorporated into the official document "Integrating Health in Urban and Territorial Planning: A Source - book " jointly issued by the World Health Organization (WHO) and the United Nations Habitat (UN Habitat) [12] As its core theoretical basis, Professor Hugh Barton, director of the World Health Organization Collaborating Center for Healthy Urban Environments (the author of the "Rainbow Mechanism Map of Environmental Health"), has published this in his latest book "Shaping Neighborhoods: Promoting Local Health and Global Sustainable Development" ( Cited in Shaping Neighborhoods for Local Health and Global Sustainability (3rd edition) [13]. This article further optimizes and proposes a "health risk-resource-behavior" spatial intervention gradient model to construct an advanced relationship among three paths: from baseline control (health risk), support and guarantee (health resources) to intervention promotion (health behavior), as shown in Figure 1. The health risks of baseline control include external disease sources and human exposure (exposure). Planning can focus on functional layout, site selection, road network, etc. to ensure the spatial distance between the population and various disease sources (air pollution, noise, viruses, etc.). The health resources that support the guarantee

include 120 first aid stations, community health service centers, elderly care facilities, etc. The availability of these facilities in space and time (even economically) is the key to the controllability of planning in spatial layout. The healthy behaviors promoted by the intervention include physical activity, social interaction and reasonable diet, etc., which are important effects of planning to create high-quality spaces. This model emphasizes that spatial planning can regulate urban and rural spatial elements, and multi-path gradients improve the health performance of space, thereby promoting physical and mental health and achieving health equity. It provides a theoretical basis for multi-scale and multi-type evidence-based practices in healthy cities.

## 2 Evidence-based practice of healthy urban planning

In my country's planning system and design types, the integration of health can be considered in multi-scale and multi-type plans such as land space master planning, controlled detailed planning, community living circle planning, micro-renewal design, etc., and evidence-based practice of healthy urban planning can be carried out. Among them, the territorial spatial planning system is an overall arrangement for the development and protection of all elements of the entire territory. This is a spatial planning system that transcends the boundaries of past urban planning and incorporates various types of land and water areas, as well as urban and rural integration. The construction of the land spatial planning system provides an opportunity for the integration of health concepts into planning and construction, which is reflected in the following three changes: ① The change in value orientation. From economic development to comprehensive balance, from paying attention to land to paying attention to people, the necessity of considering people's physical and mental health in planning has been strengthened. ② The planning scope expands from urban planning areas to municipal areas, and it is necessary to consider more health-related spatial elements such as woodland and farmland and their interrelationships. For example, the interrelationship between forestry, farmland and other spatial elements and construction land affects the occurrence of zoonotic diseases. Probability of occurrence. ③ The integration of different types of planning and governance content can promote the integration of multiple health-related systems. These changes support the construction of healthy urban and rural areas. At the same time, mid- and micro-scale planning and design also provide broad evidence-based practice application scenarios for healthy space creation.

Evidence-based practice emphasizes the use of multiple types of evidence such as research results, practical experience, and residents' preferences to support practice [14]. The evidence-based practice of healthy urban planning is based on understanding the complex mechanisms of how the built environment affects health, clarifying the core planning principles and indicator parameters that significantly affect health, and providing a foundation and guidance for planning and design practice. Healthy city research towards evidence-based practice requires bridging the gap between academic research and planning practice [15].

The technical process of evidence-based practice of healthy urban planning can include current situation diagnosis, program preparation and program evaluation, integrating health concepts into the whole process of planning and design, and realizing spatial health intervention at multiple spatial scales (Figure 2). According to the theoretical model, the

current status diagnosis section can include analysis content such as health risks, health resources, and health behaviors. In the planning stage, it is very necessary to optimize the existing planning principles based on the relevant research conclusions of healthy cities and healthy geography, and also add specific planning content for health. In the program evaluation stage, a health effect evaluation mechanism is established for the program and its implementation. As the last step of the closed-loop healthy urban planning, it forms feedback and optimization of the two aforementioned work processes.

Specifically, health risk diagnosis oriented to current situation analysis aims to identify the multiple negative effects of built environment elements on health. Multiple influencing factors on public health and their representation data can be systematically superimposed, such as the superposition of various pollution source distribution and wind environment, the superposition of crowd activity gathering points and heat island conditions, the superposition of specific disease high-incidence areas and socioeconomic health determinants, etc.; accurate identification Health risk areas within the planning scope to identify key areas that need improvement for urban development and renewal. Health resource diagnosis aims to analyze whether existing health facilities and services meet the needs of different groups of people at different times and scenarios. It can conduct detailed analysis of the spatio-temporal behavior and needs of groups of people with different characteristics (including age, income, residence and occupational characteristics, etc.), and measure their compatibility with the service scope, type and scale of health resources (including medical resources, physical exercise resources, etc.) . In particular, public health research shows that diseases occur more frequently in groups with fewer social connections or in lower social classes [16]. At the same time, an analysis of the current status of health resources should be carried out to identify the emergency capabilities and transformation potential under specific circumstances, and then determine the facilities that require combined emergency planning and design renovation. Health behavior diagnosis aims to identify the positive effects of built environment elements on health. The effect of existing health elements in a specific city on promoting healthy behaviors of the population, such as measures of street walkability and bikeability, can be analyzed so that they can be maintained and optimized in planning. These three types of diagnosis can measure the health performance of the space, identify high-risk areas for health, identify the need for additional and optimized health resources, and strengthen the design of healthy behavior-supporting environments.

Evidence-based practices in the planning and design process need to be based on the intervention paths of chronic non-communicable diseases and infectious diseases based on spatial elements, and put forward health promotion guidance requirements for various spatial elements. For example, in the overall land and space planning, the work content can be combined with existing planning content to carry out health risk avoidance, or increase the layout of health emergency resources. Health risk avoidance can be combined with ecological space layout and red line delineation to reduce the risk of spillover of space pollutants and infectious disease pathogens [17-19]. The supply of health resources can focus on the layout of 120 emergency facilities. Through spatial layout and path optimization, the pre-hospital emergency response time can be shortened to reach the international standard of 8 minutes [20]. In the mid- and micro-level planning, public health units can be delineated based on

community living circles, and a high-level health support network integrating rehabilitation care, medical care, data monitoring, epidemic management and other functions [21-22] can provide daily health promotion and emergency services. Provide important spatial support and facility guarantees in response to public health emergencies.

When comparing and selecting plans, it is necessary to consider the possible positive and negative effects of the plans on the physical and mental health of residents [23]. Program health effect assessment may include measuring or predicting health intermediary benefits (such as physical activity equivalents) or health outcomes (such as life expectancy) to support program comparison and optimization. The evaluation by qualitative methods can be based on expert scoring or resident interviews; the evaluation by quantitative methods can be based on the calculation of potential health effects based on model parameters of empirical studies. Health effect assessment is carried out after the plan is implemented. On-site observations can be carried out to clarify the health effects of construction updates, thereby confirming the effect of specific planning and design practices and verifying the effectiveness of the plan in providing space health performance.

### 3 Future Framework of Healthy City Science: Two Sectors of Cognition and Intervention

Evidence-based practice has put forward new requirements for the future direction of healthy city science, including how to solve the problem that the evidence provided by the research results is relatively single or the research conclusions are difficult to go deep enough to support the design details [24], and whether the research results have the scope of applicability. limitations, and whether the evidence provided by a single study result is heterogeneous across multiple studies and practices [24-26]. At present, a large amount of research focuses on single-point breakthroughs in specific spatial elements, making it difficult to cover the multi-faceted and complete health design required by practitioners. Therefore, researchers of healthy urban planning need to fully consider the background conditions, problems and characteristics of the practice objects, incorporate the spatial planning indicator system into the analysis, advance in depth from the cognitive sector and the intervention sector, and form effective interactions between the two sectors. , mutual feedback and support, and build a future framework of healthy city science in which cognition and practice promote each other, as shown in Figure 3.

The cognitive sector focuses on the health effects of urban spatial evolution and its rules of action. There are long logical chains and complex interfering factors in the impact of space on health. Therefore, the mechanism of space health requires in-depth exploration. Current empirical studies are mostly cross-sectional, using regression models and spatial statistical models for correlation analysis. The single spatial element model explores the impact and role of specific spatial elements on health outcomes, such as how the layout and size of green space affects respiratory diseases. The multi-element spatial scene model is an integrated upgrade on the single spatial element model. It analyzes how the spatial scene formed by multiple elements affects health effects, such as how the site design characteristics and vegetation configuration characteristics of the park promote the diversity of physical activities [27- 28]. However, the time evolution effect including multiple elements needs to be quantified, so as to further explore key cognitive contents such as evolution mechanisms,

causal paths, and critical thresholds. The future research direction will be the "multi-element multi-space-time evolution model" that adds the time dimension, emphasizing the flow of various elements that change over time in different spaces, which will help to more deeply reveal the relationship between spatial elements, human behavior and health outcomes. complex mechanism of action.

The intervention sector focuses on the role of space in "preventing disease" through planning, design and governance implementation, including the hardware of space creation and the software of space governance. It is an evidence-based practice based on cognitive discovery. Space creation emphasizes the arrangement of physical space in planning and design; spatial governance emphasizes the construction and supporting mechanisms and systems. Existing planning and construction attach great importance to economic and aesthetic dimensions, and it is necessary to stimulate the health-promoting potential of space to a greater extent through planning and design. The future research and development direction will be to develop planning and control methods and technologies that coordinate multi-dimensional health goals and quantifiable health performance, so as to improve the physical and mental health of the population.

#### 4 Healthy city industry-university-research linkage system

In order to continue to promote the three key tasks of research, practice and education, it is necessary to build a scientific industry-university-research linkage system for healthy cities (Figure 4). With urban and rural planning as the core, based on interdisciplinary integration and innovation such as medicine, geography, biology, etc., a cross-professional full-chain training model is established to train doctoral students to explore complex mechanisms in depth, and to train master's and undergraduate students to master and develop methods for healthy urban planning. And technology.

Specific methods may include: integrating interdisciplinary knowledge units into current courses, establishing new interdisciplinary courses, and establishing interdisciplinary dual degree programs. It is easier to integrate interdisciplinary knowledge units into current courses. Currently, Tongji University has added healthy city-related content to both theoretical courses and design courses at both the undergraduate and graduate levels.

At the undergraduate level, a healthy city planning module has been added to the urban and rural planning principles course to introduce the correlation between urban and rural space and public health. The architectural detailed planning and urban design courses have integrated the ideas and themes of healthy planning and design, integrating site thinking and designing spaces with healthy performance into the design. In the undergraduate graduation project, he has continued to guide students to carry out health-oriented planning research and spatial design. At the graduate level, the urban design research course has selected themes such as biophilic design, healthy community design, and child-friendly space. It has also added modules in conjunction with theoretical courses related to urban development to introduce the research progress and research methods of healthy urban planning.

The integrity of the delivery of interdisciplinary knowledge in Healthy Cities Science can be improved through the creation of new interdisciplinary courses. Currently, Tongji University

has launched an interdisciplinary course on healthy urban science, inviting professors from disciplines such as medicine, environment, surveying and HVAC to participate in the co-construction, and introducing new technologies such as Alibaba Cloud models into teaching methods to cultivate students with interdisciplinary foundations. Knowledge, thinking logic and analytical methods [29]. Course objectives include: Understand the important concepts of healthy and sustainable community, urban and regional environments; Understand the impact of interactions and feedback pathways between urban system elements on the health and well-being of urban residents, have the ability to identify urban health risks, master assessment Health resource layout tool, understand the health behavior supporting environment; try to apply the interdisciplinary knowledge learned to solve existing urban and rural population health problems by formulating planning and design strategies. Knowledge points include: core concepts and terminology such as full life cycle health, the impact mechanism of gene-environment interaction on health, intervention methods for the built environment to promote health and prevent diseases, etc.

The establishment of an interdisciplinary double degree program will cultivate interdisciplinary talents more systematically. Universities such as Harvard University and the University of Southern California in the United States have launched dual-degree programs in urban planning and public health [30]. The three different dual-degree postgraduate training models in different disciplines, across colleges and across schools within the college can systematically integrate interdisciplinary courses and research directions and cultivate talents with interdisciplinary innovation capabilities [31].

## 5 Conclusion

The difference between healthy urban planning and general urban planning is mainly reflected in three aspects: ① Planning that emphasizes space economy may have excessive building density or low green space rate, and schools are too close to high-traffic roads; healthy urban planning emphasizes The health performance of space takes control of health risks as the bottom line. ② Good planning and design creates beautiful and comfortable spaces, which can promote health, but lacks quantitative representation and makes it difficult to show health effects; healthy urban planning is committed to showing and quantifying the health performance of space to provide support for good plans. ③New content that was not considered in the original plan has been added, such as risk identification of public health emergencies, layout of 120 first aid facilities, etc. Overall, the essential difference is that health becomes an important value goal. By adopting healthy urban planning, spatial adjustment can be turned into a means of promoting health in urban renewal and development, and the health of the population can be improved at the front end of health intervention.

Building healthy cities is not only the forefront of global urban research, but also an important carrier for the implementation of the "Healthy China" national strategy and the United Nations Sustainable Development Goals "Health and Wellbeing" (SDG3: good health and wellbeing). In the face of severe global health challenges, urban and rural planning is an important part of the multi-disciplinary and multi-sector collaborative response mechanism. The planning community has once again attached importance to the important role of urban planning in public health, but it needs to further explore the science of healthy cities and

promote healthy urban planning from mechanism policies, research practices to teaching and educating people. The impact of different spatial levels and types of planning on health needs to be deepened and the extent and threshold clarified. Innovative research and development in terms of mechanisms, methods and technologies are needed. Systematic analysis of urban spatial elements that affect human and environmental health and their action paths will enrich the concept and connotation of healthy cities, improve the theoretical system of spatial planning intervention in public health, and provide a more solid and rigorous foundation for the evidence-based practice of healthy city planning.

Promoting healthy city scientific research and planning evidence-based practice for people's lives and health will promote the health-oriented upgrading of urban and rural planning disciplines and innovation in the planning industry, promote the healthy transformation and development of urbanization, and contribute to the implementation of the urban and rural spatial planning perspective for the construction of a community of life for humans and nature. plan. Contribute Chinese wisdom to meet the common health challenges faced by global cities and move towards a healthier future for mankind and the planet .