Research on the Psychological Health Impacts for Children in Urban Built Environments

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Abstract:

In recent years, the incidence of psychological and behavioral problems in children has increased, making it a critical intervention target within the framework of the Healthy China Action. The development of children's psychological health is influenced by a myriad of factors, with psychological biases potentially accumulating over time and evolving into psychological health issues such as depression and autism. Various disciplinary fields address the development of children's psychological health through genetic factors, family dynamics, social surroundings, and material space. Among these, urban and rural planning disciplines optimize the material spatial environment through planning design and indicator regulation, mitigating or reducing biases in children's psychological development and thus preventing or ameliorating the psychological health risks they face. Existing studies indicate a substantial correlation between factors of the urban built environment and residents' psychological health, exerting long-term, sustained, widespread, and subtle effects on psychological well-being with the potential for optimization and improvement. Moreover, owing to their social vulnerability, health susceptibility, and highly malleable biological characteristics, children's psychological health is particularly susceptible to the influence of urban built environments. The developmental trajectory of children's psychological health possesses unique characteristics, and their utilization and experience of urban space differ from that of adults. Some studies have noted that certain material spatial elements relevant to adult psychological health may not hold the same significance among children and adolescents. Therefore, in urban planning research addressing the psychological health needs of children, the following questions merit further elucidation: (1) What constitutes the specific connotation of children's psychological health, and what comprises psychological health at different age stages? (2) What are the characteristics of the effects of urban built environments on children's psychological health? (3) What potential impact pathways exist during this process? This article aims to explore the impact of the urban built environment on children's psychological health across these three dimensions. Comprehensive interdisciplinary research seeks to clarify the concepts, processes, and compositions of children's psychological health, along with the psychological health characteristics of children across all age groups; extract and identify elements and characteristic indicators of the urban built environment, analyzing their impact pathways from various perspectives on the psychological health benefits for children.
Keywords: Children's Psychological Health; Urban Built Environment; Interdisciplinary Research

1. Introduction

The healthy development of children is crucial for determining a nation's future potential. With the advancement of modernization, improvements in living environments, and enhancements in medical care, there has been a significant improvement in children's health levels. However, simultaneously, there has been a rising occurrence of and public concern about psychological health issues in children.

Existing research suggests a significant correlation between urban built environment elements and residents' psychological health. These influences are long-term, continuous, extensive, and subtle, with the potential for optimization and improvement. Additionally, due to their social vulnerability, susceptibility to health risks, and highly malleable biological characteristics, children are particularly susceptible to the influences of urban built

environments (Evans, W, G. and Ferguson, T, K., 2011). The developmental process of children's psychological health is unique, as children utilize and experience urban spaces differently from adults. Some studies have also found that certain material spatial elements relevant to adult psychological health are not significant among children and adolescents (Foster, S. et al., 2015). Interventions in children's psychological health development across various disciplinary fields, including genetic factors, family atmosphere, social environment, and material space, are crucial (Culbertson, L, J., Newman, E, J. and Willis, J, D., 2003). Urban and rural planning disciplines aim to alleviate or reduce biases in children's psychological development through planning design and indicator regulation to optimize material spatial environments. Consequently, this helps prevent or ameliorate the psychological health risks faced by children.

Therefore, in the context of urban planning research focusing on children's psychological health, further clarification is required on the following issues: (1) What are the specific connotations of children's psychological health and the psychological health characteristics at different age stages? (2) What is the relationship between urban built environments and children's psychological health? (3) What are the pathways through which urban built environments affect children's psychological health? These will provide insights for the construction of child-friendly cities.

2. The composition and age characteristics of children's psychological health

The meaning of psychological health has become increasingly enriched with the development of medical, psychological, and social psychological service systems, extending gradually from individual mental aspects to various facets including cognition, language, emotion, and social adaptation (Bhugra, D., Till, A. and Sartorius, N., 2013). Research on children's psychological health focuses on the developmental processes of psychological behavior based on brain development and the associated issues arising from biases (Shvaleva, M, N. et al., 2018). Children's psychological health emphasizes the changing processes of psychological and behavioral development, exhibiting stage-specific characteristics at different age stages while demonstrating a continuity of mutual influence and connection throughout the overall developmental process. The age range of children can be divided into four stages: infancy, preschool, school-age, and adolescence (Clay, T. and Fox, G., 2008).

(1) Cognitive Ability

Cognition generally refers to the process of knowing or cognitive activities, which is a higher psychological activity that reflects the characteristics, states, and interrelations of objective things in the brain, and reveals the significance and effects of things on individuals (Chernikova, V, I., 2014). Cognitive development is closely related to changes in brain morphology and the development of brain function. Cognitive abilities mainly include aspects such as perception, memory, attention, and thinking (Flavell, H, J., 1992).

(2) Emotions and Feelings

Emotion is the attitude experience generated by whether objective things meet human needs, reflecting the relationship between objective things and human needs (Rodríguez, L., Ramos, F. and Wang, Y., 2012). Feelings are attitude experiences related to whether advanced social needs are satisfied, gradually formed in the practice of social interaction, such as feelings of friendship, morality, beauty, and rationality (Keung, H., 2013). This is a unique emotional state of human beings. Emotions and feelings play an important role in the lives and overall psychological development of children and adolescents, influencing their cognition, behavior, social relationships, and personality formation and development (Suveg, C., Southam-Gerow, A, M. and Goodman, L, K., 2007).

(3) Personality and Socialization

In the process of growth and development, influenced by various factors, each individual gradually forms a unique personality. At the same time, as social beings, humans inevitably form various relationships with others and gradually develop sociality. The development of sociality is crucial for children, as well as for groups and society (Mukhina, V., 1982).

2.2 Age Characteristics of Children's Psychological Health

(1) Infancy (0-3 years old)

During infancy, children's brains develop rapidly, marking a key period of cognitive, motor, and language development, as well as the initial stage of personality formation (Bornstein, H, M. and Shriver, K, E., 2015). Scholars widely agree that psychological development during infancy is the result of interactions between individuals and their environment (Sale, A., Berardi, N. and Maffei, L., 2014).

(2) Preschool Period (3-6 years old)

As children acquire language skills, they begin to engage in representational thinking. However, thinking at this stage tends to be rigid and irreversible (Ulu, E. and Kiraz, A., 2014). Children's emotional experiences become quite rich during this period, gradually developing higher-level emotions such as trust, sympathy, aesthetic sense, and morality. Moreover, they begin to develop self-awareness and can begin to regulate their activities and behaviors (Brown, T. and Jernigan, L, T., 2012).

(3) School Age (6-12 years old)

Psychological development in school-age children, including attention, thinking, and emotions, is more stable compared to preschoolers and adolescents (Collins, A, W., 2001). Their memory and imagination abilities undergo significant development, and they exhibit various forms of human emotions. The stability and regulation ability of their emotions gradually strengthen (Ferdinand, K, N. et al., 2018).

(4) Adolescence (12-18 years old)

During adolescence, thinking becomes more comprehensive and profound. Adolescents exhibit psychological characteristics that retain traces of childhood while also showing the emergence of various adult behaviors (Brizio, A. et al., 2015). Their sense of morality, rationality, and aesthetics undergo significant development. Their interpersonal relationships become more complex, and they engage in meaningful social activities (McLaughlin, A, K., Garrad, C, M. and Somerville, H, L., 2015).

In summary, infancy is a critical period for psychological development, with infants exhibiting significant plasticity. The preschool period prepares children for school before formal education begins. School age represents a significant transition period in psychological development. Adolescents' psychological characteristics become richer and more stable.

3. Factors influencing children's psychological health

Psychological health refers to a state of complete psychological well-being, encompassing both positive and negative aspects (Bhugra, D., Till, A. and Sartorius, N., 2013). Research on psychological health has been conducted across various disciplines, including psychology, medicine, sports science, education, sociology, geography, and urban planning (Fusar-Poli, P. et al., 2020). Numerous studies have shown that psychological health is influenced by a diverse array of factors, which can be classified medically into biological factors and

psychosocial factors (Singh-Manoux, A., Macleod, J. and Davey, S., 2003).

Children's psychological health emphasizes the changing processes of psychological and behavioral development, exhibiting stage-specific characteristics at different age stages while demonstrating a continuity of mutual influence and connection throughout the overall developmental process. Similarly, the influencing factors follow medical classifications and can focus on intrinsic genetic and individual factors as well as external environmental factors. External environmental factors can be further categorized into social determinants, family environment factors, and material environment factors. The pathways of influence can be direct or indirect through behavioral means.

3.1 Endogenous influences

Genetic and individual factors are endogenous influences on children's psychological health, determining the potential for children's psychological health development. At the same time, the development and changes of these potentials are also subject to various external environmental constraints and interventions. The prenatal cortisol levels and telomere lengths of parents with adverse childhood experiences can affect their offspring through genetic or environmental pathways, thereby increasing the risk of psychological problems in children such as negative emotions, depressive symptoms, and defiant behaviors. However, the impact of genetic factors during childhood is much lower than that of external environmental factors (Gene–environment interactions in psychopathology throughout early childhood: a systematic review, 2015)(Vendlinski, K, M. et al., 2014), and the degree of influence diminishes with age(Franić, S. et al., 2010). In terms of individual factors, temperament traits, personality characteristics, cognitive abilities, self-awareness, and other aspects all influence children's psychological health. The family environment is an important external environmental factor that contributes to children's psychological health (Aronen, T, E., 1991)(Ferguson, T, K. et al., 2012)(Hank, K. and Steinbach, A., 2018).

3.2 Exogenous influences

With the rapid development of society, external environmental factors have gradually increased their impact on children's psychological health, making family environment, social environment, and material environment hot topics in this field. The influence of family environment on children's psychological health is profound. Factors such as family economic status, family atmosphere, family structure, parenting styles, and parental education level all have varying degrees of influence on children's psychological health (Bornstein, H, M., 2013)(Veronese, G. et al., 2014)(Manor-Binyamini, I. and Naamneh, G., 2019). In terms of social influences, socioeconomic background, cultural differences, medical services, personal social interactions, neighborhood cohesion, and school life all impact children's psychological health (Perna, L. et al., 2010)(Immelt, S., 2006)(Ferguson, T, K. et al., 2013). Social psychological stress exposure is one of the most significant factors affecting adolescent depression (Twenge, M, J., 2020).

Material environment has a significant impact on children's psychological health (Jevtić, M. and Bouland, C., 2019). The impact of climate change on children's psychological health includes direct effects on emotions, stress, and happiness, as well as indirect effects such as trauma, post-traumatic stress disorder, depression, and cognitive development disorders resulting from secondary disasters (Karaliūnienė, R. et al., 2022)(Cianconi, P., Betrò, S. and Janiri, L., 2020)(Xu, Z. et al., 2012). Studies in regions such as Northern Europe and North America have found seasonal variations in the incidence of psychological health problems in children, such as anxiety disorders, obsessive-compulsive disorders, attention deficit hyperactivity disorder, and severe depression (Nillni, I, Y. et al., 2009)(Kovalenko, P. et al.,

2000)(Copeland, N, J. et al., 2022). Children are particularly susceptible, and exposure to environmental factors such as air pollution, noise, electromagnetic radiation, and radiation can disrupt the normal development of children's psychological behavior. Due to children's faster respiratory rates and lower activity spaces, various air pollutants such as vehicle exhaust, cooking fumes, and odors from garbage are more likely to trigger emotional responses in children, and even cause respiratory system damage, leading to lung inflammation and poisoning (Song, J. et al., 2018). Different types of noise pollution from traffic, construction, and neighborhoods can affect the activity and function of children's nervous systems, leading to psychological health risks such as depression and anxiety (Schubert, M. et al., 2019). Children have larger pupils than adults, and facilities such as nighttime lighting or overly bright signs and illuminated buildings with high contrasts in environmental light are more likely to inhibit children's melatonin secretion, affecting their circadian rhythm regulation (Navara, J, K. and Nelson, J, R., 2007). Exhaust deposition and meltwater containing de-icing agents can cause heavy metal or chloride pollution in soil and surface water, affecting children's intellectual and immune function development (Brockmeyer, S. and D'Angiulli, A., 2016).

3.3 The influence of children's behavior on psychological health

Children's behavior is the outward expression of their lifestyle and habits, serving as an intermediary factor for various psychological influences. Children's activity behavior includes physical activity, sedentary behavior, and sleep (Karwowska-Struczyk, M., 1998).

Physical activity refers to any activity that involves energy expenditure through skeletal muscle contraction, including exercise training, daily chores, commuting, and other leisure activities, which may occur in urban outdoor environments. The social-ecological model suggests that the main influencing factors of children's physical activity behavior include: a. Individual factors such as motivation, skills, attitudes, knowledge, and perception; b. Interpersonal relationship factors such as family, peers, teachers, and social support; c. Institutional or organizational factors such as school regulations, attention from relevant departments, and health services; d. Community factors such as public green spaces, recreational facilities, and road traffic, as well as neighborhood effects; e. Public policy factors such as laws and regulations, education policies, financial support, and public health strategies (Gao, W. et al., 2022).

Outdoor physical activity is closely related to children's psychological health and promotes the cultivation of willpower, cognitive abilities, optimistic emotions, and good interpersonal relationships. Physical activity affects children's psychological health through three pathways: biological factors, individual psychological factors, and social psychological factors (Biddle, H, J, S. et al., 2019). Biologically, physical activity can improve sleep and alleviate childhood depression by increasing hippocampal volume (Vancampfort, D. et al., 2018). Psychologically, physical activity can improve self-esteem and self-efficacy mechanisms to alleviate childhood depressive symptoms (Ahn, S. and Fedewa, L, A., 2011). Socially, physical activity enhances children's social connections, increases social support, and reduces anxiety (Gorham, S, L. et al., 2019).

4. The factors and pathways of urban built environment impact on children's psychological health

In the process of urban planning, the elements of urban built environment intertwine with the factors affecting residents' psychological health, mutually influencing each other. Numerous studies have confirmed that the urban built environment has long-term, sustained, extensive, and subtle effects on residents' psychological health, with the possibility of optimization and

improvement (Núñez-González, S. et al., 2020)(Gascón, M. et al., 2015)(Gong, Y. et al., 2016)(Clark, C. et al., 2007). Building on this foundation, scholars have further focused on the child population, conducting research on the impact of community built environment, external building environment, urban green-blue spaces, and equity of facilities on children's psychological health (Villanueva, K. et al., 2016)(The influence of the neighborhood physical environment on early child health and development: A review and call for research., 2015)(Alderton, A. et al., 2019)(Hitch, L. et al., 2023). Buttazzoni constructed a research framework for urban planning and children's psychological health from the perspective of neuro-urbanism (Buttazzoni, A., Doherty, S. and Minaker, L., 2021), which has significant reference value.

4.1 Influencing factors

Research on urban planning for children's psychological health is closely related to the concept of child-friendly cities, which align with the 12 characteristics outlined by the United Nations Children's Fund (UNICEF) (Vliet, v, W. and Karsten, L., 2015). The urban planning elements influencing children's psychological health are highly similar to the healthy environment and services that children should enjoy, including green-blue spaces, land use, road layout, space site, and service facilities.

(1) Green-blue spaces

Green spaces such as water bodies, parks, and walking trails have various beneficial effects on improving children's physical and mental health and rarely induce negative behaviors. The proportion of green spaces and their accessibility determine children's opportunities to interact with nature. Insufficient green space indicators reduce children's contact with nature, diminish their environmental perception and activity levels, leading to phenomena such as nature deficit and psychological and behavioral problems (Vanaken, G. and Danckaerts, M., 2018). Microscopic spatial visual indicators such as green view ratio, color richness index, sky openness index, and transparency affect children's sense of security, comfort, and pleasure (Dadvand, P. et al., 2014). Excessively monotonous and desolate green spaces are detrimental to the formation of children's attention and imagination and may even lead to emotional depression and disorders (Engemann, K. et al., 2019).

(2) Land use

Land use indirectly affects children's psychological health by influencing their physical activity. Moderate physical activity helps alleviate children's emotional problems and promote cognitive development. The intensity of community land development affects children's physical activity levels. Building height is positively correlated with children's physical activity levels (Li, L. and Hin, ., 2009). Overall building density is negatively correlated with children's physical activity (Durand, P, C. et al., 2011). Mixed land-use environments in communities promote children's physical activity (Masoumi, E, H., 2017). Additionally, the building layout and spatial form of high-rise communities alter the microclimate environment, affecting children's immune, nervous, and skin systems to varying degrees (Vanos, K, J., 2015).

(3) Traffic layout

The richness of social activities and interfaces, population density, and pedestrian accessibility on streets affect children's activity preferences (Villanueva, K. et al., (no date)). The safety of intersections, parking forms, and pedestrian facilities influence parental supervision and significantly determine children's physical activity decisions (Carver, A., Timperio, A. and Crawford, D., 2008). Behavioral activities are crucial intermediary factors

in streets' impact on children's psychological health and affect children's perception and nervous system development (Tappe, A, K. et al., 2013).

(4) Space site

In recreational spaces within urban public areas, factors such as zoning functional complexity, composition of gaming elements, and size of connection areas influence children's choices of social behaviors (Dong, N., Chen, J. and Zhang, S., 2017). The accessibility of sports facilities and the cleanliness and attractiveness of activity environments affect children's physical activity, thereby influencing their psychological health development (Xiao, Z. and Li, H., 2012).

(5) Service facilities

Service facilities are closely related to children's health risks. The service scope and accessibility of medical facilities affect the emergency response time for children's accidents and the availability of medication for children in need of psychological healing (Savagea, R., Helfer, B. and Lash, M., 1997). The types and accessibility of retail and food facilities affect the variety of food children can access and the balance of nutritional intake. Low-income communities are more prone to "food deserts," increasing health risks such as childhood overweight and obesity (Ploeg, V, M., 2010), affecting children's personality and social development. The accessibility and visibility of tobacco and alcohol retail facilities affect children's exposure probability and increase tobacco smoke exposure, affecting children's neurological and respiratory health (Marsh, L. et al., 2021), thus influencing the formation and development of perception.

4.2 Influencing pathways

Urban built environments primarily affect children's psychological health through two pathways: direct effects on senses and indirect effects through spatial or service changes. The former directly impacts children's psychological health under environmental stressors (such as environmental colors, housing congestion, neighborhood safety, etc.). The latter involves changes in social interactions, physical activity, and environmental perception resulting in psychological behavioral changes such as a sense of belonging, security, or discomfort (Franklin, M. et al., 2020). Additionally, indirect impact mechanisms are not limited to the above processes and can produce multiple or multidirectional potential influences, such as physiological health mapping and coexistence of promotion and inhibition. For example, research has found that when children are in environments with low street connectivity or school accessibility, they tend to choose active commuting modes such as walking or cycling (Pabayo, R. and Gauvin, L., 2007). Such commuting modes can increase their psychological well-being and reduce psychological stress. From the perspectives of neurobiology, social psychology, and behavioral science, green spaces have been found to improve children's psychological health levels by reducing exposure to harmful factors, enhancing recovery capabilities, and strengthening self-capabilities (Vanaken, G. and Danckaerts, M., 2018). However, the specific results are influenced by children's socioeconomic backgrounds.

5. Research Prospects

In the fields of medicine, psychology, education, sociology, architecture, landscape architecture, and urban planning, both domestically and internationally, research has been conducted on the factors influencing children's mental health, including genetic and individual factors, family factors, social environment, and physical environment. This research has accumulated certain methodologies and findings, highlighting the specificity of children's mental health development. It's recognized that children's use and experience of urban spaces

differ from those of adults. Additionally, some studies have found that certain physical spatial elements related to adult mental health are not significant among children and adolescents. Therefore, it's necessary to conduct research on the impact of built environments on mental health specifically targeting children, this unique population.

The practice and research of building child-friendly cities mainly propose planning and design methods from the perspective of urban public spaces, residential areas, and streets, with a greater focus on children's physiological and behavioral needs and safety risks. Although some scholars have conducted research on children's psychological development, much of it focuses on special groups of children and specific mental health issues. Moreover, the translation and application of relevant research results into planning intervention paths in the practice of building child-friendly cities still require further exploration. Therefore, it's particularly important to conduct research on the mechanisms and planning intervention paths of the impact of built environments on mental health at the scale of school districts, which is most relevant to the daily lives of school-age children.

In the field of urban planning, many studies are limited to cross-sectional data due to data constraints, although the medical field often uses correlation analysis methods based on cross-sectional and panel data in research on factors affecting mental health. The mechanisms through which built environment elements in urban school districts affect children's mental health are complex. Cross-sectional data-based correlation studies cannot control for potential variables, thus reducing the accuracy of mechanism analysis and making it difficult to determine causality. Therefore, integrating longitudinal tracking experiments and analysis methods from other disciplines such as medicine and psychology and incorporating a time dimension through the comprehensive use of panel data to quantitatively explore the relationship between urban school district built environments and children's mental health holds significant scientific value.

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