COGNITIVE SCIENCES AND HUMAN DEVELOPMENT

Effects of Urban Built Environment on Mental Health: A Review

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ABSTRACT

This paper presents a systematic review of how prior research on the influence of the built environment on mental health has progressed. The study utilised open-access journals to cover environmental, public health, landscape, and urban planning databases from 2000 to 2021, focusing on specific keywords. Five major themes emerged from the research. Most studies from the early 2000s to 2014 focused on the negative consequences of a poorly constructed built environment on mental health. Since 2015, the focus has shifted to a broader context, primarily the urban environment, its relationship with mental health and how it contributes to positive mental health. Finally, evidence of changes in the context and circumstances may shed light on the research's future trajectory.

Keywords: physical environment, built environment, mental health, mental well-being

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1 INTRODUCTION

The nation's rapid urbanisation is caused by a rapid increase in the urban population as a proportion of the total (Trivedi et al., 2008). According to the Nation (2018), urbanisation, or the continuous change in human residency from rural to urban regions, combined with global population growth, might add another 2.5 billion people to cities by 2050, with Asia and Africa accounting for 90 per cent of this rise. As a result of increased urbanisation, the physical environment has grown increasingly exposed to risk factors. As a result, stress levels rise, related to mental health issues (Chiavegatto Filho et al., 2017; Collins et al., 2011; Gruebner et al., 2017; Roh et al., 2016).

The World Health Organization (WHO, 2005) describes mental health as the establishment of well-being, including emotions, thoughts, and feelings, the ability to solve problems and overcome difficulties, social connections, effective functioning for an individual and community, and an understanding of the world around us. An essential part of good mental health is looking at problems or concerns realistically, which is influenced by life experiences, relationships with others, physical health, and one's environment (Felman, 2020). Saloni et al. (2018) defined 970 million people worldwide who have a mental health or substance abuse disorder. Anxiety is the most common mental illness globally, affecting 284 million people, followed by depression, affecting 264 million people. Its cost is expensive for societies worldwide, and the median cost varies by mental disorder kind and country (Christensen et al., 2020). There are two types of factors that can affect mental health: those that affect mental health directly, such as density, pollution, and housing quality, and those that affect mental health indirectly, such as personal control, social support, and fatigue and stress recovery (Chu & Thorne, 2004).

Individual well-being and a thriving, resilient society depend on good mental health. Despite many established factors that contribute to mental health, i.e., biological, and psychological, there is an emerging awareness that urban built environments have a profound effect on mental health (Cohen, 2017). The physical and social aspects of city life can influence mental health and well-being positively and negatively (Health, 2016). The design and planning of the built environment are about adapting the physical environment and space for human purposes that make communities function, facilitate business, make organisations efficient, support family life and the like. In practice, the result that can be used is a pattern of shaped and interconnected spaces that aim to facilitate social goals. The built environment can encourage active lives both directly and indirectly, influencing people's health and well-being to span the physical aspects of where they live and work (Villanueva et al., 2013).

The relationship between the features of the urban physical environment and mental health has attracted much attention in recent decades. Rebecchi et al. (2019) indicated that the urban physical environment is crucial to health and well-being because it can influence the city's livability and behaviour and encourage or discourage people from being active. It can also increase a person's ability to resist an unhealthy lifestyle. Previous research has investigated the relationship between mental well-being and community characteristics such as green and blue spaces, green space accessibility, green space size and function, physical activity, public facilities, open spaces, socio-economic deprivation, residential security, and income equality (Cohen-cline, 2015; Cohen, 2017;

Evans et al., 2013; Fan et al., 2011; Melis et al., 2015). Improving green infrastructure can improve the quality of life for adults (Moore et al., 2018).

Several changes are being made to the physical environment that are known to have a variety of consequences for the mental health of urban communities, resulting in changes in how the causes and effects are examined. However, built environment features such as crowding, noising, dangerous places, and lighting would have an undesirable impact on people and their psychological conditions, like depression, anxiety, stress, and violent behaviour (Evans, 2003; Sullivan & Chang, 2011). It is, therefore, timely to provide an overview of the evolution of previous research to gain a better understanding of the effect of the built environment on mental health.

2 METHODOLOGY

Only papers published in the last two decades (2000–2021) were included in this study. The review utilised open-access journals such as Web of Science, ScienceDirect, ProQuest, PubMed, and Google Scholars and environmental, public health, landscape, and urban planning databases. Articles with at least 20 citations from many sources are subject to searches, and only recently published papers are considered. The search keywords are "physical environment" (e.g., pollution, green space, open space), "built environment" (e.g., neighbourhood, urban, constructed, street), and "mental health" (e.g., well-being, stress, anxiety, depression). Papers are screened by titles and abstracts to determine their relevance to the topic. The studies are then evaluated for inclusion in the final review based on their eligibility. The data retrieved included author disciplines, publication year, study location, study design, study population, sample size, data source, and significant and non-significant findings on the relationship between built environment characteristics and mental health outcomes. The content of each study was categorised into qualitative built environment result groups based on common descriptions of the outcomes reported in the studies.

3 RESULT AND DISCUSSION

The initial electronic database search yielded 298 hits on the Web of Science, ScienceDirect, ProQuest, and PubMed. There were 15 duplicate records among these that were eliminated. A total of 199 papers were removed from the study because their titles or abstracts did not meet the requirements (Figures. 1). As a result, 84 entire texts were thoroughly reviewed and evaluated for eligibility. Finally, 23 full-text papers detailing research that examined the urban built environment in conjunction with mental health were included.

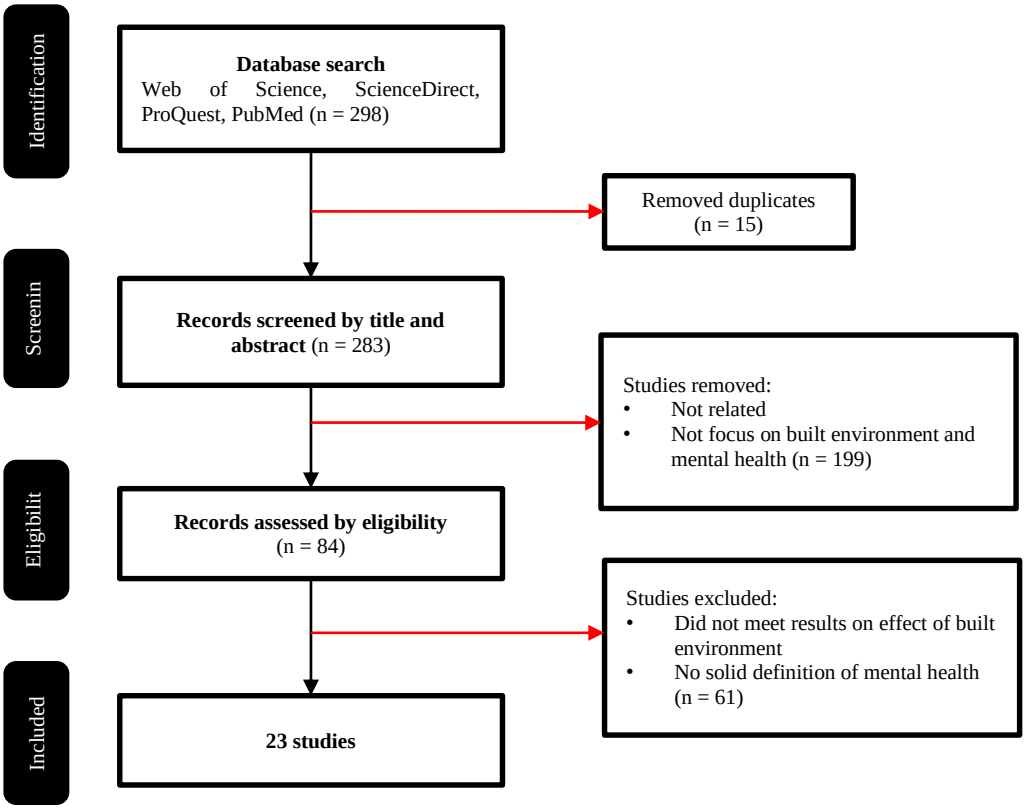

Figure 1. The flow of the review process.

Four of the selected studies were longitudinal studies (Gariepy et al., 2015; Guo et al., 2021; Liu et al., 2020; Melis et al., 2015), and the rest were cross-sectional studies. Studies were conducted mainly in the United States (*N* = 5) and the United Kingdom (*N* = 4) from 2000 to 2017, from 2018 until 2021. Studies were primarily conducted in China (*N* = 7). The size of the study population was very heterogeneous among studies, ranging from 100 to 547,263 participants. Most studies, however, are focused on adults and employ various survey tools, which include the General Health Questionnaire (GHQ), to evaluate mental health (Table 1) (Liu et al., 2020; Paydar et al., 2020; Qiu et al., 2019; Sarkar et al., 2013; Zhang & Li, 2017). Warwick-Edinburgh Mental Well-being Scale (WEMWBS) was used to measure people's mental well-being (Qin et al., 2021; Wood et al., 2017; Zhu et al., 2021).

Table 1. Main characteristics of the studies on built environment factors on mental health.

Author (Year, Country)	Study design	Tools to measure Mental health	Indicator	Key finding
Evans et al. (2000) United States	Cross-sectional Subjects = Adult women with child N = 207	Demoralisation Index of the Psychiatric Epidemiology Research Instrument – Psychological distress	• Housing Quality • Cleanliness/Clutter • Indoor Climatic Conditions • Privacy • Hazards • Structural Quality • Child Resources • Neighbourhood Quality	Changes in housing quality are linked to psychological distress.
Weich et al. (2002) United Kingdom	Cross-sectional Subjects = Adult N = 1887	Center for Epidemiologic Studies Depression scale – Depression	• Deck access • Properties built 1940-1969 • Properties built 1970 or later • <1/4 dwellings with private gardens • No shared recreational space • Disused buildings • Many patches of graffiti	Certain factors of the built environment have been correlated with poor mental health.
Galea et al. (2005) United States	Cross-sectional Subjects = Adult N = 1887	National women's study (NWS) depression module – Depression	• Internal built environment • External built environment	Individuals who dwell in a poorly built environment suffer from depression for six months.
Guite et al. (2006) United Kingdom	Cross-sectional Subjects = Adult N = 1012	SF-36 mental health and vitality scores – Mental health	• Internal environment • Design and maintenance • Noise • Density and escape • Fear of crime and	Low mental health or vitality scores, or both, remained strong predictors of the built environment.

			harassment • Social capital	
Araya et al. (2007) Chile	Cross-sectional Subjects = Adult (16-64 y) N = 3870	Revised Clinical Interview Schedule – Psychiatric symptoms	• Internal environment • Design and maintenance • Noise • Density and escape • Fear of crime and harassment • Social capital	There is clear evidence that people who live in areas with more favourable characteristics have a higher quality of life.
Miles et al. (2011) United States	Cross-sectional Subjects = Older adults (>65 y) N = 1980	Center for Epidemiological Studies-Depression (CES-D) scale – Depression	• Housing density • Land use diversity • Acres green space • Auto commuter density • Economic deprivation • Residential stability • Age concentration	Aspects of urban form are linked to depressive symptoms.
Roe et al. (2013) United Kingdom	Cross-sectional Subjects = Adult (33-55 y) N = 106	Perceived Stress Scale (PSS) – Stress	• % of green space	When differing levels of green space were considered, gender differences in stress levels were found.
Sarkar et al. (2013) United Kingdom	Cross-sectional Subjects = Older adult N = 687	30-item General Health Questionnaire (GHQ-30) – Psychological distress	• Dwelling level • Land use configuration • Physical accessibility of streets • Topography • Greenness • Area-level deprivation	There is a relationship between psychological distress and measurements of the built environment.
Ochodo et al.	Cross-sectional	Mini-International	• Types of walls • States of roofs	A wide range of external built-residential environment

(2014) Kenya	Subjects = Adult N = 544	Neuropsychiatric Interview (MINI) plus – Mental health	• Heights of roofs above the ground • States of windows • Types of windows • Types of doors • Access pathways for walking or vehicles • Street lighting	characteristics can be found in poor developing countries.
Gariepy et al. (2015) Canada	Longitudinal Subjects = Adult (43 y) N = 7114	Composite International Diagnostic Interview Short-Form for Major Depression (CIDI-SFMD) – Depression	• Presence of any park • Presence of any healthcare service • Presence of any healthy food store • Presence of any fast-food restaurant • Presence of any cultural service	There is a link between aspects of a neighbourhood's built environment and depression symptom trajectories.
Melis et al. (2015) Italy	Longitudinal Subjects = Adult (20-64 y) N = 547263	Depressive symptom	• Density • Functional mix • Green and pedestrian areas • Cultural and leisure facilities • Accessibility by public transport	Antidepressant medicine prescriptions decrease when certain aspects of the built environment improve.
Zhang & Li (2017) United States	Cross-sectional Subjects = Adolescent (11-15 y) Adult (16-60 y) N = 308	General Health Questionnaire and Mental Health Inventory – Mental health benefits	• Physical activity in the park • Physical activity travelling to the park • Park induced physical activity • Physical activity in residential green space	Visits to the park elicited a wide range of favourable emotions.
Wood et al. (2017) Australia	Cross-sectional Subjects =	Warwick-Edinburgh Mental Well-	• Distance to the closest park • Number of parks	Parks have a vital role in mental health.

	All ages N = 492	being Scale (WEMWBS) – Positive mental health	• Area of parks • Parkland functions • Park function	
Xiao et al. (2018) China	Cross-sectional Subjects = Adolescent (15 y) Adult (>16 y) N = 251	National Health Survey and the World Health Organization's World Mental Health Survey (WMH) – Mental health	• Housing conditions • % of facilities • Neighbourhood satisfaction	Housing conditions were linked to neighbourhood satisfaction, which had a considerable favourable impact on mental health.
Liu et al.(2019) China	Cross-sectional Subjects = All ages N = 1029	Five-item World Health Organization Well-Being Index (WHO-5) – Well-being	• Neighbourhood greenness • Time spent walking for recreation • Satisfaction with neighbourhood greenspace • Perceived pollution	Greener neighbourhoods were associated with higher levels of mental well-being.
Qiu et al. (2019) China	Cross-sectional Age Subjects = Adult (>18 y) N = 1150	12-item General Health Questionnaire (GHQ) – Mental health	• Building density • Per capita green area • Neighbourhood floor area ratio	The built environment and mental health have a positive relationship.
Rugel et al. (2019) Canada	Cross-sectional Subjects = Adult (>14 y) N = 1930048	2012 Canadian Community Health Survey-Mental Health (CCHS-MH) – Mental health	• Residential surrounding greenness • Visible nature • Accessible neighbourhood nature	There is little evidence that natural space exposure has a substantial indirect influence on Major Depressive Disorder.
Paydar et al. (2020) Iran	Cross-sectional Subjects = All ages	General Health Questionnaire (GHQ-28) – Mental health	• Comfort primarily due to lack of other vehicles • Arrangement of	Somatic symptoms have a significant negative correlation with built environment factors.

	N = 355	disorder	visual sequences along with landscape • Arrangement of social setting along with landscape • Comfort considering the quality of surfaces and public transport availability • Accessible stores and coffee shops • Personal security	
Liu et al. (2020) China	Cross-sectional Subjects = Adult N = 1150	12-item version of the GHQ-12 – Mental problem	• Neighbourhood surrounding greenness • Neighbourhood surrounding blueness	Neighbourhood street-view greenness and blueness have beneficial effects on individuals' mental health.
Yang & Xiang (2021) United States	Cross-sectional Subjects = Adult N = 2667	Patient Health Questionnaire-2 items (PHQ-2) – Depressive symptoms Generalised Anxiety Disorder-2 items (GAD-2) – Anxiety symptoms	• Neighbourhood condition • Neighbourhood change during COVID-19 pandemic • Physical activity	During the pandemic, changes in neighbourhood conditions were not linked to any mental health outcomes.
Qin et al. (2021) China	Cross-sectional Subjects = Adult N = 701	7-item version of the Warwick-Edinburgh Mental Wellbeing Scale (SWEMWBS) – Mental health	• Neighbourhood floor area ratio • Average house price • Mixed land use • NDVI	Physical activity may play a role in linking green space and mental health.
Zhu et al. (2021)	Cross-sectional	Warwick-Edinburgh	• Floor area ratio • Year built	Access to public open spaces has a considerable beneficial

China	N = 590	Mental Well-Being Scale (WEMWBS) – Mental health	• Average house price • Activity • Environmental quality • Amenities • Safety	impact on mental health.
Guo et al. (2021) China	Longitudinal Subjects = Older adult N = 2317	Mental Component Summary (MCS) scale of the 12-item Short-form Health Survey (SF-12) – Mental health	• Density • Design • Diversity • Destination	Higher residential density was related to a better perception of the built environment and subjective well-being.

Adverse mental health outcomes (depression, anxiety, and psychological distress) from 2000 to 2014; and positive mental health outcomes (mental and psychological well-being) from 2015 to 2021 are the two categories of research linking the built environment and mental health published over twenty years. These categories are classified based on the quality of the built environment, with a poor built environment leading to poor mental health outcomes and vice versa in past years. Then, depending on the period within those years, the focus of this research can slightly alter.

Utilising mental health variables to synthesise the concept, four distinct themes were developed: studies on poor housing environment quality, studies on poor built environment quality, stressors in the built environment, and conducive built environment design (Table 2). These themes are also linked to two types of mental health outcomes: negative and positive mental health. This theme is sorted by year; from 2000 to 2004, the study concentrated on the housing environment, which has a detrimental impact on mental health. From 2005 to 2009, the study widened its scope to include the built environment. According to the study, the environment has become a stressor that negatively impacts mental health from 2010 to 2014. However, from 2015 to 2021, the study has concentrated on mental well-being, highlighting the built environment as a factor that can improve mental health.

Table 2. Themes of papers.

Year	Themes
2000-2004	Studies on the poor quality of the housing environment
2005-2009	Studies on the poor quality of the built environment
2010-2014	Stressors in the built environment
2015-2021	Conducive built environment design

The tools for measuring mental health are different as they measure psychological distress and depression. In the early 2000s, two published papers emphasised that housing and neighbourhood characteristics can, directly and indirectly, affect mental health. Both studies focused on low- and middle-income neighbourhoods and new and old neighbourhoods. The scope of the built environment is limited to building design and structures and other factors such as shared recreational space, private gardens, and graffiti. However, there is no evidence provided with no significant correlation. Evans et al. (2000) demonstrated that individuals persistently exposed to home crowding and noise had strained interpersonal connections and lower motivation linked with learned helplessness. Furthermore, people living in areas characterised by modern development with a predominance of deck access had significantly higher rates of depression than people living in areas characterised by older construction (Weich et al., 2002).

In papers published between 2005 and 2009, there was a minor change in research focus to the broader built environment. During this time, research connected poor mental health to various built environment factors, including house satisfaction, green space, pedestrian-friendly and accessible destinations, and public transportation. The researchers also found a correlation between a poor built environment and mental illness in people. The study compared those who lived in urban areas with those who lived in areas with a better-built environment, such as housing areas classified as middle-income despite being inwards with high levels of deprivation, and those who lived in areas with a better-built environment, such as housing areas classified as middle-income despite being inwards with high levels of deprivation.

In 2005, they continued to focus on building design and structural elements, including environmental features such as streets and sidewalks. Therefore, Galea et al. (2005) discovered that living in a low-quality built environment might expose people to many daily stressors and difficulties, which can lead to depression. Significant factors that are included in the studies are the external built environment. For example, green space, community facilities, social and entertainment facilities, street lighting, vandalism, litter, area quality, and traffic were studied more broadly in 2006 and 2007. The most critical factors that operate independently are neighbouring noise, a sense of overcrowding in the home, escape facilities, and fear of crime (Guite et al., 2006). The factor is supported by Araya et al. (2007), who discovered a link between the quality of a small geographic area's built environment and the incidence of prevalent mental diseases among its population.

In 2010, research started to identify built environment elements as stressors or buffers of personal

sources of stress related to mental illness. Economically deprived neighbourhoods or noise may serve as stressors, while easily accessed green spaces can maintain mental health. Miles et al. (2011) examined the relationship between neighbourhood urban form and depressive symptomology based on people who live in neighbourhoods with no green space and those who live in areas with plenty of green space. However, how residents live in and use the environment is equally relevant. For example, there are significant gender variations in stress patterns based on green space levels, with middle-aged women in lower green space areas reporting higher stress levels than middle-aged men (Roe et al., 2013). According to Ochodo et al. (2014), external residential environment features affect the mental health of adults in low- to middle-income neighbourhoods.

The population in urban residential areas with a poor quality external built environment is significantly exposed to daily stressors and inconveniences, which increases the risk of developing mental health disorders. Sarkar et al. (2013) also indicated that living in a terraced dwelling, land use configuration, topological accessibility of the street, natural environment, and area-level deprivation were stressors used in the studies.

Studies linking the built environment to mental health emerged after the relationship between the urban physical environment and physical well-being (Fisher et al., 2017; Lau et al., 2018; Ling et al., 2020; Mabahwi et al., 2018). In the latter half of this decade, studies began to examine the attributes of a good-quality urban built environment that can promote mental well-being. This period also witnessed a shift in the methodology as 30% of the research employed a longitudinal study design while the rest maintained the cross-sectional method. It shows that they studied people with the consumption of antidepressants and experienced depression, but there was one study that focused on data collection of built-environment features.

According to Melis et al. (2015), individual traits had the most significant association with antidepressant medicine usage, whereas, among built environment indicators, public transportation accessibility and urban density are just minimally defensive factors for mental health. They do, however, believe that the built environment (green and pedestrian area, land use mix and sports facilities) has a more significant impact on people who spend more time in the neighbourhood having more opportunities to move around and have an active social life, good public transportation as well as a dense urban layout (as opposed to sprawl). In trajectory groups (low and moderate prevalence of depression symptom episodes), the existence of a neighbourhood park was likewise a significant protective factor (Gariepy et al., 2015).

Positive mental health determinants (based on the built environment) and mental well-being improvement were emphasised. Physical activity in parks, for example, considerably improved visitors' emotions and energy levels, and connection with nature brought mental health benefits in terms of relaxation and self-perceived confidence (Public Health Officer of Canada, 2017; Wood et al., 2017; Zhang & Li, 2017). Rugel et al. (2019) and Xiao et al. (2018) found similar results, confirming that exposure to neighbourhood greenery is associated with a stronger sense of community belonging and, as a result, improved mental health.

Mental health was also linked to neighbourhood safety, contextual neighbourhood interactions, and reciprocity, according to Qiu et al. (2019). Using the models they utilised, they discovered that the neighbourhood floor-area ratio, building density, and per capita green area were all associated with mental health. There is no direct link between natural space and significant depressive disorder, poor mental health, or psychological distress, according to Rugel et al. (2019). In a densely populated Chinese context, Liu et al. (2019) found no indication that greenery in residential surroundings reduces stress or mitigates air/noise pollution. The subjective measure of stress/pollution and the minimal fluctuation in stress/pollution levels within the studied neighbourhood contribute to this.

People nowadays have a higher urge to participate in outdoor or social activities in a variety of venues or locations in order to preserve their mental health (Tracy et al., 2020). As a result, in an urban region where studies have improved the current built environment qualities, the built environment plays an essential role in improving people's mental health (Guzman et al., 2021; Liu et al., 2020; Paydar, Fard & Khaghani, 2020; Qin et al., 2021; Zhu et al., 2021). Green, natural, and blue space in the area has a direct and indirect good impact on people's mental health through promoting neighbourhood attachment and community participation. In a densely populated and congested metropolitan environment, there is a positive association between the quality of public open space and mental health (Qin et al., 2021; Zhu et al., 2021).

Physical activity and social cohesiveness may play a mediation role in the relationship. As a result, Paydar et al. (2020) focused on how walking attitudes and various perceived environmental characteristics influence walking attractiveness and general/mental health, suggesting the need for novel visual sequences and social situations along these sidewalks. Negative neighbourhood variables, including crime and traffic, were associated with a reduced risk of mental health problems, whereas healthy neighbourhood circumstances were linked to more moderate physical activity (Yang & Xiang, 2021). The relationship between residential density and subjective well-being may be entirely explained by the perception of the built environment and a sense of community. The total effects of land use mix on mental health and subjective well-being were positive, while perceptions of the built environment and emotions of the community were somewhat mediating (Guo et al., 2021).

Mccay et al. (2019) concluded that the built environment could promote good mental health and well-being for urban residents, encourage the mental health and well-being of vulnerable people, and facilitate the recovery of those with psychological problems throughout their lives as city residents, and this study backs up their findings. Improving conditions for active travel and public transportation, providing easy access to facilities and services, developing technology and new mobility alternatives, incorporating various forms of urban nature, and providing accessible and inclusive public spaces, according to Mouratidis (2021), are all potential strategies for linking the built environment to better health. However, this study has several limitations, such as the fact that it focuses primarily on the built environment, although there are studies that look at the impact of both the built and social environments on mental health. This study also does not focus on the significant built environment factors in mental health.

4 CONCLUSION

This study gives an overview of prior studies to better understand the impact of the built environment on mental health. According to the investigation, researchers have consistently proven a link between the built environment and mental health over the previous two decades. Although the numerous subjects of the papers were grouped into five-year periods for this study, it should be noted that there is no clear dividing line between them because the scope and focus of the research often overlapped. The study established the subject's expanding scope and area of interest despite this. It can be observed that the concept of the built environment has been expanded from initially referring to the physical criteria of a building (structure or building design) to include the neighbourhood area and, later, the neighbourhood facilities such as green and open space for outdoor activities. Attributes of facilities were also increasingly refined to include usage, accessibility, attractiveness, visual frequencies, and social situation. The focus of the research has shifted from the negative effects of the built environment to the beneficial contribution of the environment to mental health, resulting in recommendations for how the built environment might be enhanced further to benefit society. This finding could also aid in improving environmental planning, resulting in a healthier urban environment for the general public. Future research and planning investigations into the parts of the built environment that influence mental health will be aided by these insights.

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