

Review

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Health, Technology And Built Environment Nexus: A Systematic Literature Review

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Review

Health, Technology and Built Environment Nexus: A Systematic Literature Review

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Abstract: Research into health, particularly social and psychological health, is crucial. Ultimately, an in-depth understanding of social and psychological health will more than promote well-being. Technology research is indispensable, particularly concerning health and the built environment, given the need to create holistic and supportive frameworks for well-being. Moreover, because literature reviews establish the foundation for academic inquiries, they provide valuable overviews for foresight into grey research areas, particularly multi-disciplinary research like health technology and the built environment. Hence, this study aims to discover the existing themes on health, technology, and built-environment nexus subjects while revealing the grey areas and suggesting proactive areas for future research. The objectives drove this aim to: 1. investigate the implications of technology for the social and psychological dimensions of health; 2. uncover the likelihood of a nexus between health, technology, and the built environment; and 3. highlight new research perspectives for the concluding seven years of the SDGs (2024–2030). The review results highlighted ten themes around which a nexus exists between health, technology, and the built environment; they also pointed out new research perspectives for the next seven years (up to 2023).

Keywords – Built environment; Health; QoL and Technology

Introduction

Research into health, particularly social and psychological health, is crucial for several reasons: 1. Understanding the intricate links between social and psychological factors and overall health is essential for developing effective preventive and therapeutic interventions. Social determinants, such as socioeconomic status, community support, and access to education, significantly impact an individual's well-being. 2. Psychological factors shape health outcomes, including stress, mental health, and coping mechanisms. By identifying risk factors, protective factors, and pathways to resilience, research in these areas aids in developing focused strategies to enhance health outcomes. 3. Insights gained from such research contribute to creating comprehensive healthcare policies and interventions that address the holistic needs of individuals and communities.

Ultimately, an in-depth understanding of social and psychological health promotes individual well-being and facilitates the establishment of more equitable and effective healthcare systems on a broader societal level.

Technology research is indispensable, particularly in connection to health, as it enables the development and enhancement of innovative solutions that can positively impact health outcomes. Technological advancements have the potential to revolutionise healthcare delivery, making it more accessible, efficient, and patient-centric. For instance, telemedicine and digital health applications facilitate remote access to healthcare services, reducing barriers to care, especially for individuals in underserved or remote areas. Moreover, technology aids in collecting and analysing vast amounts of health data, contributing to evidence-based decision-making and personalised medicine. Combining machine learning and artificial intelligence algorithms makes it possible to predict health risks, optimise treatment plans, and provide insights into disease patterns. Additionally, technology provides platforms for health education, mental health support, and community engagement,

addressing the social and psychological aspects of well-being discussed earlier. Technology research creates avenues for implementing cutting-edge tools and strategies, fostering a more interconnected and technologically advanced healthcare ecosystem that ultimately benefits individuals and communities.

Connecting the importance of technology and health, research into the built environment becomes crucial in creating holistic and supportive frameworks for well-being. The built environment encompasses physical spaces where individuals live, work, and engage in daily activities. Understanding how these spaces influence health, in conjunction with technological and healthcare advancements, provides a comprehensive approach to fostering optimal well-being. Urban planning, architecture, and environmental design research contribute to creating environments that promote physical activity, social interaction, and mental well-being. For instance, walkable neighbourhoods, green spaces, and well-designed public spaces can positively impact physical and psychological health outcomes. Integrating technological innovations into the built environment, such as smart infrastructure and sustainable design, further enhances the potential for creating healthier living environments. Therefore, research into the built environment complements technological and healthcare advancements and addresses the physical and spatial dimensions that contribute significantly to overall health and quality of life.

Furthermore, literature reviews establish the foundation for academic inquiries. Stand-alone reviews can summarise prior work, test hypotheses, extend theories, and critically evaluate a body of work. These reviews contribute to scholarly knowledge and serve as valuable overviews for foresight into grey research areas, particularly multi-disciplinary research.

Hence, this study aims to discover the existing themes on health, technology and built environment nexus subjects while revealing the grey areas and suggesting proactive areas for future research. The article follows a structured order: the upcoming section outlines the research methods, details the steps taken to derive the review results, and presents the results and discussions. The concluding section offers evidence-based suggestions for future research directions and initiatives.

Methods

This review article encompassed three significant stages: planning, executing the review, and reporting. The planning stage included identifying the need to review a nexus between health, technology, and the built environment, outlining the research questions, and developing a review protocol. The review phase involved identifying and selecting primary studies and data extraction, analysis, and synthesis. Then, the final stage, the reporting stage, includes the dissemination of literature review findings.

We have simplified these stages into eight steps: 1. Research problem formulation; 2. Review protocol development and validation; 3. Literature search; 4. Literature inclusion test/screening; 5. Quality assessment; 6. Data extraction; 7. Data analysis and synthesis; and 8. Reportage. Though linearly outlined, these processes were somewhat iterative, with back-and-forth where required.

Step 1: Problem formulation –

Research inquiries are guided by questions typically targeted at probing a problem. This research's questions were threefold: 1. What are the implications of technology for the social and psychological dimensions of health? 2. Is there a nexus between health, technology, and the built environment? and 3. What research perspectives are of imminent importance in the concluding seven years of SDG goals (2024–2030)?

A pre-review mapping constituting tripartite indices—1. a range of subtopics; 2. the frequency of studies within each subtopic; and 3. the years researchers undertook the studies.

Step 2: Review protocol development and validation –

The study aims to discover the existing themes about health, technology, and the built environment nexus while revealing the grey areas and suggesting proactive areas for future research on the same subject. In line with this purpose, the review protocol's design includes research questions, inclusion criteria and screening procedures, data extraction, synthesis, and reporting strategies.

Step 3: Literature search –

The literature search channels:

There are three known literature-sourcing strategies in research – forward searching, backwards searching, and electronic databases. Forward search includes all articles that cited the reviewed articles, and backward searches are all relevant articles cited by reviewed articles. Since no database contains all published materials, the literature for this review was sourced from various databases.

Literature search keywords and phrases:

The literature search employed keywords and phrases derived from dissecting the research questions into concept domains. Hence, the review has four keywords – health, technology, built environment, and QoL (Quality of Life). The search phrases were derived from a matrix of the three keywords, resulting in what the authors adopted as SQLs (Search Query Languages). For easy documentation and data management, these key keyphrases were encoded with alphabets A, B, C, and D, as shown in Table 1 below:

Table 1. shows search keyphrases.

S/N	CODE	SQL
1.	A	Healthy Built Environment
2.	B	Technology in/and the Built Environment
3.	C	QoL and Technology
4.	D	QoL and the Built Environment

Table 2. shows a matrix of keywords turned into keyphrases and used as SQLs in various databases.

	Health	Technology	Built Environment	QoL (Quality of Life)
Health			Healthy Built Environment	
Technology			Technology in/and the Built Environment	QoL and Technology
Built Environment	Healthy Built Environment	Technology in/and the Built Environment		QoL and Built Environment
QoL (Quality of Life)		QoL and Technology	QoL and Built Environment	

In the context of the research questions, the matrix considers the health and Quality of Life (QoL) pair as synonymous, resulting in the absence of a match between them. Likewise, no keyword matched with QoL includes health in the pairing. Additionally, when searching the databases, we opted for QoL over Quality of Life because the latter generated numerous non-relevant search outcomes, increasing the literature volume to a less manageable level.

Sampling strategy –

Sampling strategies could be exhaustive and comprehensive or selective and representative, depending on the purpose of a review. Non-scoping descriptive reviews operate by a rule of thumb: the more comprehensive, the better, but they do not require total inclusion of all literature categories in any given domain (Xiao & Watson, 2019). The strength of this literature sampling in this review was limited to academic content from journals, book chapters and research reports.

Refining Search Results –

Further refinement of search results involved the exclusion of closed-access journals and limiting the search to the five years of 2020 to 2024 to ensure the currency of data in the context domain under review.

Stopping Rule –

This research employed a rule of thumb for its search-stopping rule. We concluded the search for each database when repeated searches yielded consistent results, and no additional information was acquired.

Step 4: Literature inclusion test/ screening –

At this review stage, after compiling the references list, the researchers conducted a further screening of each article to determine its eligibility for data extraction and analysis. The procedure's efficiency enhancement comprised two stages. Initially, a coarse sieving of articles was conducted based on the review of abstracts, followed by a comprehensive quality assessment based on full texts. These steps were essential to eliminate articles irrelevant to the research question(s).

Literature Inclusion/Exclusion Criteria –

The criteria for inclusion and exclusion were primarily derived from the research question(s) and subsequently extended to the subject area. Excluded articles were those unrelated to – addressing technological implications on social and psychological health, revealing whether there is a nexus between health, technology, and the built environment, and suggesting the future of research in the light of the preceding two questions. For literature excluded based on the subject area, all articles not within the following subjects were excluded – Health, Technology, and Built Environment disciplines. A complete list of all specific disciplines is available in Table 3 below.

Table 3. shows specific disciplines used in the Inclusion/Exclusion Criteria by subject area.

DATABASE	SUBJECT AREAS		
	Health	Technology	Built Environment
Scopus	Medicine; Nursing; Biochemistry, Genetics and Molecular Biology; Health Professions; Psychology; Agricultural and Biological Sciences; Neuroscience; Decision Science; Immunology and microbiology.	Engineering; Energy; Computer Science; Mathematics; Physics & Astronomy.	Environmental Science; Social Sciences; Arts & Humanities; Earth & Planetary Sciences; Business Management & Accounting.
Google Scholar			
DOAJ			
JSTOR	Psychology; Public Health.	Computer Science; Engineering; Technology.	Architecture/Architectural History; Environmental Science/Studies; Garden & Landscape; Sustainability.
ProQuest			

Journal Storage (JSTOR); Directory of Open Access Journals (DOAJ).

Step 5: Quality Assessment

We conducted a comprehensive quality assessment examining the full text for methodological biases. This process included analysing the logic of the methodology, spanning from data collection through data analysis, results, and conclusions.

Step 6: Data Extraction

The researchers extracted information from the findings and discussion of each study, focusing on two types of findings: 1. those linking technology to social and psychological health dimensions, and 2. those indicating or explicitly establishing a connection between health, technology, and the built environment.

Step 7: Data Analysis and Synthesis

Using charts, tables, figures, and textual descriptions, we categorised data from all articles based on the research questions they addressed. The initial step involved analysing data related to research

questions one and two. We synthesised the results of these analyses to address the third research question.

Step 8: Reportage

A presentation of results using charts, tables and textual data description and a discussion of the results obtained poised at addressing the research questions and ultimately meet the purpose of the study, which is to identify themes and provide direction for future research in the context of health, technology, and environment nexus.

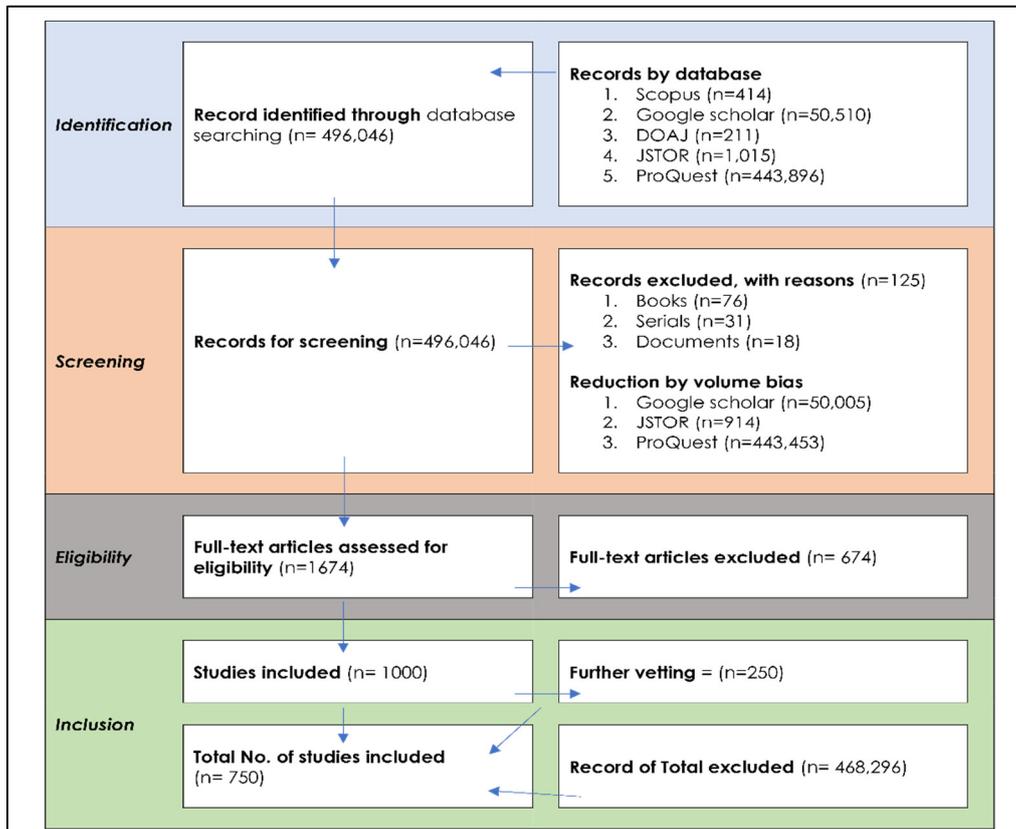


Figure 1. Shows literature Inclusion test/screening.

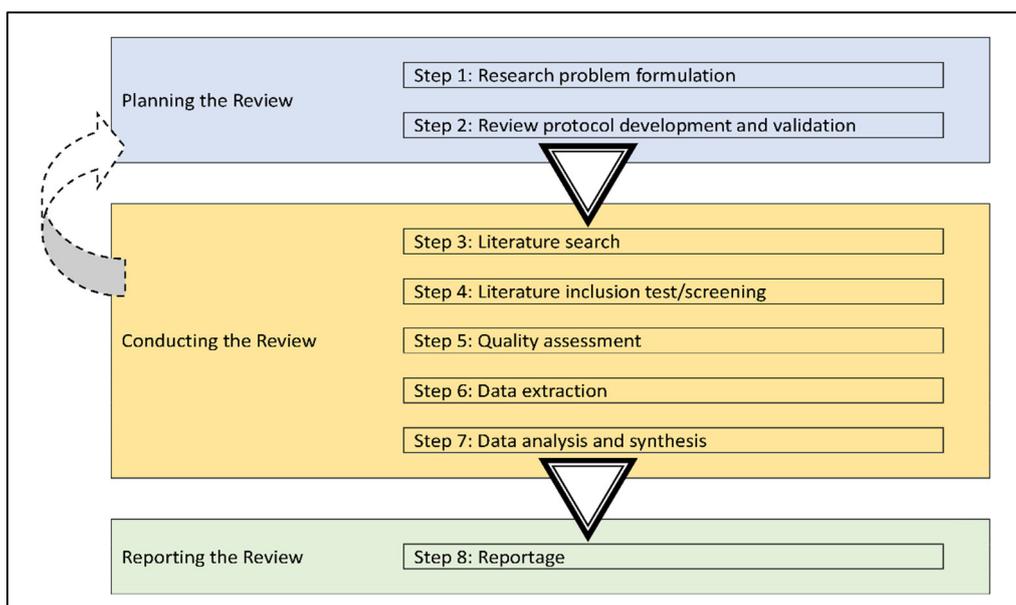


Figure 2. Shows the Literature review process.

Results

The literature review process undertaken by the authors revealed various outcomes of interest. The following paragraphs will be presented based on the three research questions in the chronology they were asked (as presented earlier).

1. Addressing the question on the implications of technology for the social and psychological dimensions of health –

The implications of technology for social and psychological dimensions of health are profound and multifaceted, impacting individuals and communities in various ways. Critical implications posited in the literature include positive impacts such as:

Increased Connectivity and Social Interaction:

Social media and communication platforms, integral as technology tools, actively enhance social connectivity by facilitating real-time communication, bridging geographical gaps, and strengthening relationships with friends and family. Users actively maintain contact, sharing updates and experiences and fostering continuous connections in the virtual space. These platforms are essential for fostering a sense of community because they enable people to actively engage in the lives of those in their social circles. Additionally, the digital space provided by social media serves as a supportive environment, offering a platform for expressing thoughts and emotions and receiving encouragement and understanding from friends and family. These technology tools contribute dynamically to enriching social lives, fostering meaningful connections, and providing emotional support in the contemporary digital landscape (Arriaga et al., 2020; Olsson et al., 2020).

Digital Mental Health Support: In revolutionising mental health services, technology actively provides accessible resources. Mobile applications, tailored explicitly for mental well-being, equip users with tools for mood tracking, meditation, and stress management, ensuring continual support. Online counselling platforms exploit technology to connect individuals with licensed professionals, eliminating geographical barriers and offering flexibility in seeking assistance. With technology, virtual support communities allow members to share their stories and ask for assistance, fostering a sense of belonging and lowering feelings of loneliness. By making many digital resources more affordable or accessible, integrating technology into mental health services increases accessibility and affordability for a larger audience (Borghouts et al., 2021; Lattie et al., 2022).

Personalisation and Tailored Interventions: Technology actively facilitates personalised health interventions, particularly in mental health. Specialised tools such as mental health apps offer tailored services, including mood tracking, meditation guidance, and stress management, allowing users to customise their approach based on individual goals. This targeted support ensures precise assistance aligned with specific mental health needs, creating a more effective and personalised approach. Overall, technology provides individualised solutions by acknowledging and addressing each user's diverse psychological and social needs, showcasing its potential to revolutionise mental health interventions with a tailored and responsive approach (Kasula & Kasula, 2023; Young et al., 2021);

Enhanced Communication in Healthcare: Technology revolutionises communication between healthcare providers and patients by introducing efficient and accessible channels. Through digital platforms, remote consultations become feasible, enabling patients to engage with healthcare professionals without needing physical presence, enhancing convenience, and overcoming geographical constraints. Technology facilitates remote mental health assessments, offering early detection and intervention opportunities. Additionally, digital tools streamline the delivery of health information, allowing healthcare providers to share updates, resources, and educational materials with patients. Technology's transformative impact improves communication dynamics, making healthcare services more adaptable, accessible, and patient-centred (Pradhan et al., 2021; Ratta et al., 2021);

Therapy Based on Augmented Reality (AR) and Virtual Reality (VR): AR and VR technologies actively demonstrate promise for transforming therapeutic interventions for mental health. These immersive technologies create controlled and safe environments for mental health interventions, as

evidenced by studies such as Rizzo and Shilling (2017) and Emmelkamp and Meyerbröker (2021). In the realm of exposure therapy, these technologies prove effective in simulating anxiety-inducing scenarios, providing individuals with a controlled setting to confront and manage their fears, particularly in treating conditions like PTSD and phobias (Bell et al., 2020; Kan Yeung et al., 2021; Slater et al., 2020; Torous et al., 2021). Moreover, research suggests that AR and VR applications are actively being explored for stress reduction interventions, leveraging virtual environments to promote relaxation, mindfulness, and effective stress management strategies (Bogdandy et al., 2020; Kim et al., 2020; Killç et al., 2021). These active applications of AR and VR technologies showcase their transformative potential in advancing mental health treatments and interventions (Cerritelli et al., 2021; Eshuis et al., 2021).

On the flip side, however, there are also patterns of negative impacts, including the following:

Information Overload and Stress: Constant exposure to an overwhelming volume of digital information, driven by widespread digital device use and the demands of online communication, can contribute significantly to information overload and stress, potentially impacting mental well-being (Fu et al., 2020; Sun & Lee, 2022). The digital age has ushered in an unprecedented flow of information through various online channels, including social media, emails, and news sources. Studies emphasise the challenges of managing this information influx and highlight its correlation with heightened stress levels (Fan & Smith, 2021; Misra et al., 2020; Pang, 2021). Continuous exposure to digital stimuli and the pressure to stay constantly connected may lead to cognitive fatigue and increased psychological distress. Moreover, researchers suggest that compulsively engaging in online communication and requiring prompt responses may worsen stress, impacting overall mental well-being. Navigating this digital landscape requires understanding the nuanced interplay between information overload, online communication demands, and mental health, emphasising the importance of developing effective coping strategies and interventions (Misra et al., 2020; Phillips-Wren & Adya, 2020; Sembiring & Mokodenseho, 2023).

Social Comparison and Body Image Concerns: Social media platforms, while providing avenues for connection and self-expression, can also serve as arenas for social comparison, which may contribute to body image concerns and feelings of inadequacy, especially among younger individuals (Jiang & Ngien, 2020). The pervasive nature of social media exposes users to curated representations of others' lives, often highlighting idealised body images and lifestyles. This constant exposure can foster unrealistic beauty standards, creating a context where individuals may compare themselves unfavourably to others. The pressure to conform to these perceived standards can be particularly impactful during adolescence and young adulthood when individuals are still forming their identities and developing a sense of self-worth. Moreover, the interactive nature of social media, with features like likes, comments, and follower counts, can reinforce the tendency for individuals to evaluate their self-worth based on external validation. Comprehending these dynamics is imperative in mitigating the plausible adverse effects of social media on body image and cultivating a more affirmative virtual milieu that advances self-acceptance and overall well-being (Rounsefell APD et al., 2020; Tiggemann & Anderberg, 2019);

Privacy Concerns and Data Security: Concerns about data privacy and security may lead to heightened stress levels, particularly when individuals feel that their personal information is at risk in the digital realm (Ahmed, 2021; Dhagarra et al., 2020; Wang et al., 2020). First, on privacy concerns, there are individual autonomy and social comparison issues. Technology often involves collecting and analysing personal data for various purposes, raising concerns about individual autonomy. The erosion of privacy can impact individuals' ability to control their personal information, leading to heightened stress and a sense of vulnerability (Chennamaneni & Gupta, 2023). The prevalence of social media and other online platforms can contribute to constant social comparison as individuals engage in self-presentation and peer comparison, which can impact mental health by fostering feelings of inadequacy, anxiety, or depression as individuals perceive discrepancies between their own lives and the curated representations of others (Mann & Blumberg, 2022).

Next, data security concerns include the risk of unauthorised access and the psychological impacts of data breaches. The increasing reliance on digital platforms for health-related activities,

such as telemedicine and health apps, raises concerns about the security of sensitive health data. The risk of unauthorised access to personal health information can result in breaches that compromise individuals' mental well-being, as they may fear the misuse of their private health data (Neal Joshua et al., 2022). Instances of data breaches can have profound psychological effects, leading to feelings of violation, anxiety, and a loss of trust in digital platforms. The fear of personal information being exposed or misused can contribute to stress and mental health challenges.

Cyberbullying and Online Harassment: The digital realm provides a venue for cyberbullying and online harassment, which negatively affect people's mental health and well-being, especially in the younger age group. (Copp et al., 2021; Slaughter & Newman, 2022). The prevalence of cyberbullying and online harassment in the digital realm presents a multifaceted challenge to social and psychological health, particularly among the younger demographic. The anonymity afforded by online platforms often emboldens individuals to engage in harmful behaviours, leading to an increased risk of targeted attacks on victims, fostering feelings of vulnerability, and perpetuating a toxic online environment (Malik & Dadure, 2024). The incessant nature of online harassment can significantly impact the mental well-being of individuals, causing heightened stress and anxiety and, in severe cases, contributing to the development of mental health disorders. The younger age group, in particular, is susceptible to the negative consequences of cyberbullying as they navigate the complexities of identity formation and social integration. The psychological toll extends beyond the digital realm, influencing self-esteem, social relationships, and overall emotional resilience. Addressing this issue requires a comprehensive approach involving education on digital citizenship, effective online moderation, and mental health support to mitigate the adverse social and psychological implications arising from the dark side of digital communication (Kwan et al., 2020).

Digital Addiction and Screen Time: Excessive screen time and digital device use can contribute to digital addiction, potentially leading to physical health issues and adversely affecting sleep patterns and mental health (Browne et al., 2021; Hjetland et al., 2021). This ill use poses significant implications for both social and psychological health. The pervasive nature of digital engagement, especially among younger individuals, can contribute to the development of digital addiction, characterised by an obsessive need to be constantly connected. This addiction can lead to social withdrawal, as individuals may prioritise virtual interactions over face-to-face communication, affecting the quality of real-world relationships (Nawaz, 2023). Moreover, the blue light emitted from screens can disrupt circadian rhythms, adversely impacting sleep patterns and contributing to sleep disorders (Kumari et al., 2023). Continuous exposure to curated online content may foster unrealistic social comparisons, leading to feelings of inadequacy and heightened stress levels (Cayla et al., 2023).

Additionally, digital addiction can contribute to attention and concentration challenges, impacting academic and professional performance (Abbasi et al., 2021; Sunday et al., 2021). Thus, the ramifications of excessive screen time extend beyond physical health concerns, significantly influencing the intricate balance of social and psychological well-being in the digital age. Mitigating these effects requires fostering digital literacy, promoting healthy screen-time habits, and cultivating a mindful approach to technology use to safeguard the holistic health of individuals in contemporary society.

Interestingly, there are a few middle grounds or rather dual effects of technology on social and psychosocial health viz:

Remote Work and Work-Life Balance: Although technology makes it possible to work remotely and offers flexibility, it can also cause a blurring of the lines between work and personal life, which could increase stress and make it more challenging to maintain a healthy work-life balance (Raja & Soundarapandian, 2022; Shirmohammadi et al., 2022).

Social Isolation and Digital Divide: While technology connects people globally, it can also contribute to social isolation, and the digital divide may exacerbate existing disparities, limiting access to digital health resources for some populations (Lythreathis et al., 2022; Sen et al., 2022).

2. Addressing the question of health, technology and built environment nexus–

There are affirmations of the tripartite connection between health, technology, and the built environment. This article summarises them into ten theme clusters –

Digital Health and Telemedicine: Utilising technology to provide remote healthcare services, monitor patients, and facilitate virtual consultations, contributing to improved accessibility and convenience (Bitar & Alismail, 2021; Seixas et al., 2021);

Smart Cities and Urban Planning: An innovative strategy for creating smart cities with connected transportation networks, sustainable architecture, and interconnected infrastructure is incorporating technology into urban planning. A comprehensive integration goes beyond the mere use of digital tools and entails an inclusive urban space redesign to enhance the quality of life for residents. Smart cities optimise different aspects of urban living through technologies like artificial intelligence, data analytics, and the Internet of Things (IoT). Connect infrastructure makes real-time data collection and analysis possible to improve waste management and energy consumption monitoring. Green areas, energy-efficient structures, and environmentally friendly methods are all incorporated into sustainable design concepts to reduce environmental effects and improve indoor air quality. Transport systems that are efficient and driven by innovation in technology promote alternate forms of transportation, enhance public transportation, and use intelligent traffic management to lower traffic and air pollution (Atitallah et al., 2020; Ghazal et al., 2021; Olaniyi et al., 2023).

Moreover, the emphasis on technology integration in urban planning extends to developing intelligent governance and fostering citizen engagement through digital platforms for participatory decision-making and responsive municipal services. The overarching goal is to create urban environments that not only harness technological advancements for operational efficiency but also prioritise the well-being of residents by promoting sustainability, connectivity, and overall livability. The synergy between technology and urban planning thus becomes a key driver in shaping cities that are not only smart but also resilient, inclusive, and conducive to the flourishing of vibrant communities (Gracias et al., 2023; Hui et al., 2023; Stępniaak et al., 2021).

Wearable Technology and Health Monitoring: Literature highlights the use of wearable devices, sensors, and health apps to monitor and track individuals' health metrics, fostering preventive care and personalised health management. Integrating wearable technology, sensors, and health applications represents a transformative advancement in healthcare, providing a powerful means to monitor and track individuals' health metrics. Wearable devices, ranging from fitness trackers to smartwatches, enable real-time data collection on physiological parameters such as heart rate, physical activity, sleep patterns, and more. Coupled with sophisticated health apps, this wealth of data facilitates the proactive monitoring of an individual's well-being and the implementation of personalised health management strategies. These technologies empower individuals to take a more active role in their health, fostering preventive care by enabling early detection of potential issues and encouraging healthier lifestyle choices. The seamless integration of wearable technology into healthcare not only enhances the efficiency of data collection but also holds great promise for creating a more patient-centric, preventive healthcare paradigm (Ferreira et al., 2021; Lou et al., 2020).

Environmental Health and Sustainability: Environmental health and sustainability entail comprehensively exploring how the built environment influences physical well-being (Baobeid et al., 2021). Its examination encompasses critical factors such as air quality, water sources, and exposure to pollutants, recognising that the design and planning of our surroundings have profound implications for human health. Examining the built environment's impact on physical health, including air quality, water sources, and exposure to pollutants, with a focus on sustainable and eco-friendly design practices, is of significant empirical focus (Bibri et al., 2024; Opoku et al., 2024). Sustainable and eco-friendly design practices play a pivotal role in mitigating potential adverse effects on health by promoting environmentally conscious construction and urban planning. For instance, incorporating green spaces, optimising waste management systems, and utilising renewable energy sources contribute to creating healthier living environments (Bibri et al., 2024). The emphasis on sustainable design addresses immediate health concerns and aligns with the broader goal of preserving the planet's resources for future generations. By scrutinising the intricate interplay between the built environment and physical health and championing sustainable design principles,

we pave the way for a healthier, more resilient, and environmentally responsible future (Khan & McNally, 2023).

Community and Social Connectedness: Exploring how technology and the built environment can enhance community engagement, social connections, and support networks, contributing to positive mental health outcomes, has been identified as an empirically relevant course for inquisition (Cho & Egan, 2023; Kemp & Fisher, 2022). The intersection of technology and the built environment holds significant potential in enhancing community and social connectedness, thereby profoundly impacting mental health outcomes. Technological advancements, such as social media platforms and community-oriented apps, facilitate virtual connections and information sharing, fostering a sense of belonging even in geographically dispersed communities (Nah, Kwon et al., 2021; Nah, Lee, et al., 2021). Simultaneously, thoughtful urban planning that prioritises communal spaces, recreational areas, and mixed-use developments contributes to creating physical environments conducive to social interactions (Mouratidis, 2021). Beyond geographical boundaries, technology is a bridge, enabling individuals to connect, communicate, and establish support networks. The amalgamation of digital connectivity and well-designed physical spaces cultivates a sense of community belonging, reduces social isolation, and bolsters mental well-being. This synergy between technology and the built environment offers opportunities for diverse social interactions. It reinforces the vital role of community engagement as a protective factor against mental health challenges, ultimately cultivating resilient and connected societies (Becerik-Gerber et al., 2022).

Data Analytics and Population Health: Leveraging big data and analytics to analyse health trends, identify risk factors, and inform public health strategies, ultimately enhancing population-level health outcomes, is an existing link between health, technology and the built environment (K. J. T. Craig et al., 2021). Research arguments centre on the transformative potential of data analytics in population health. By harnessing big data and analytics capabilities, this approach seeks to analyse intricate health trends, identify risk factors, and derive actionable insights to inform and optimise public health strategies. The utilisation of vast datasets enables researchers and public health professionals to understand the health dynamics within populations comprehensively (Odunayo et al., 2023). By scrutinising patterns, correlations, and anomalies in health data, it becomes possible to pinpoint emerging trends, anticipate potential health risks, and develop targeted interventions. This research approach transcends traditional epidemiological methods, offering a real-time, dynamic, and data-driven perspective on population health (Odunayo et al., 2023; Velmovitsky et al., 2021). Ultimately, the overarching goal is to leverage data analytics to enhance the efficacy of public health initiatives, thereby contributing to improved population-level health outcomes and fostering a proactive and adaptive approach to public health management.

Inclusive Design and Accessibility: The research domain is a critical area that prioritises the development of technological and built environment solutions with universal inclusivity. The primary concern is ensuring these solutions consider individuals' diverse needs, abilities, and health conditions. Inclusive design aims to create products, technologies, and built spaces accessible to everyone, regardless of physical abilities, cognitive differences, or health conditions. This comprehensive approach goes beyond mere compliance with accessibility standards; it seeks to foster environments and technologies that promote equal participation, independence, and a positive user experience for all individuals. By addressing the unique requirements of diverse user groups, Inclusive Design not only enhances accessibility but also contributes to a more equitable and empowering society where everyone can fully engage with and benefit from technological and environmental advancements (Agost-Felip et al., 2021; Creed et al., 2023).

Public Health Interventions and Policy: This research perspective delves into the pivotal role of technology and the built environment in shaping public health interventions and policies to foster healthier environments and lifestyles. Through rigorous research, technological advancements, and thoughtful urban planning, it is possible to develop evidence-based policies promoting public health and well-being (Alruwaili et al., 2023; Egan, 2020). Technology is a powerful tool for data collection, analysis, and dissemination, enabling researchers and policymakers to gain insights into health trends, identify areas of concern, and evaluate the effectiveness of interventions. Additionally, the

built environment is crucial in influencing health behaviours and outcomes. Policymakers can create environments supporting healthier lifestyles by designing cities, neighborhoods, and public spaces that prioritise walkability, access to green spaces, and healthy food options (Balcetis et al., 2020; Baobeid et al., 2021).

Moreover, successful public health interventions often require a multifaceted approach that leverages technological innovations and environmental modifications (Iyamu et al., 2022). For example, digital health platforms can facilitate remote monitoring and telemedicine services, improving access to healthcare for underserved populations (Campos-Castillo & Mayberry, 2022; Phuongid et al., 2023). Simultaneously, urban planning strategies, such as bike lanes and pedestrian-friendly infrastructure, encourage physical activity and reduce reliance on motorised transportation, mitigating the risk of chronic diseases associated with sedentary lifestyles (Creed et al., 2023).

Integrating technology and urban planning principles into public health policymaking makes it possible to develop comprehensive strategies that address the underlying determinants of health and promote population-wide well-being. This holistic approach emphasises the importance of creating supportive environments and implementing interventions that empower individuals to make healthier choices, ultimately leading to improved health outcomes and a higher quality of life for communities.

Health Equity and Social Determinants: Examining Health Equity and Social Determinants involves a nuanced understanding of how technology and the built environment harnessment aid health disparities dismantling. By focusing on social determinants and ensuring equitable access to resources, this research area seeks to create a foundation for building healthier, more inclusive communities. This research area recognises that health outcomes have intricate links to social, economic, and environmental factors, collectively known as social determinants of health. By leveraging technology and thoughtful urban planning, there is an opportunity to mitigate health disparities and promote health equity (S. Craig et al., 2022; Goldstein et al., 2023).

In examining social determinants, researchers consider factors such as income, education, employment, housing, and community infrastructure. Technology can be employed to collect and analyse data related to these determinants, offering insights into the root causes of health inequalities. Additionally, the built environment, encompassing the design of neighbourhoods, access to healthcare facilities, and the availability of resources, plays a pivotal role in shaping the social determinants that influence health (Ferrer, 2023).

Equitable access to resources, facilitated by technological advancements and urban planning strategies, becomes a cornerstone in addressing health disparities. For example, telehealth technologies can improve healthcare access in underserved communities, and urban planning initiatives can ensure the equitable distribution of parks, healthy food options, and essential services. By addressing social determinants and enhancing access to resources, technology and the built environment become powerful tools for creating an environment where everyone, regardless of socioeconomic status, can achieve their highest level of health.

Human-Centred Design: Human-centred design (HCD) is an approach that prioritises the human experience throughout designing and implementing technologies and built spaces (Göttgens & Oertelt-Prigione, 2021). The core principle of HCD is to ensure that solutions align seamlessly with users' needs, preferences, and behaviours. Placing the user at the centre of the design process essentially acknowledges that the effectiveness and success of a technological or architectural solution depend on how well it meets the needs and expectations of the people who will interact with it (Melles et al., 2021).

HCD involves deeply understanding users through interviews, observations, and feedback collection. This sympathetic understanding is the basis for developing practical, effective, intuitive, and user-friendly solutions. The iterative nature of HCD allows designers to continuously refine and enhance their creations based on ongoing feedback and evolving user needs (Antonishak et al., 2023; Chen et al., 2020; Ferrer, 2023).

In the context of technology, this means designing software, applications, or interfaces that are not only technologically advanced but also considerate of the user's cognitive load, preferences, and

accessibility requirements. In architecture, HCD extends to the design of physical spaces, ensuring they are aesthetically pleasing and optimised for comfort, accessibility, and usability (Partarakis & Zabulis, 2024).

Ultimately, Human-Centred Design emphasises a holistic and user-focused approach to enhance the overall experience and satisfaction of individuals interacting with the designed products, technologies, or built environments. This approach fosters innovation that is not just technologically advanced but also profoundly attuned to the diverse needs and experiences of the people it serves.

3. Addressing the question on research perspectives for the future, particularly for the concluding seven years of the SDGs (2024 to 2030) –

To address this third question, the authors have analysed the technological implications in conjunction with the health, technology and built environment nexus while having empirical bases in literature for our analysis. These textual illustrations thus represent our textual synthesis of the available data.

Predicting specific research foci for the next seven years involves some uncertainty. However, several trends and areas of interest are likely to shape research on the multidimensional subject of health, technology, and the built environment:

Digital Health Integration: Future research will probably focus more on incorporating telemedicine, artificial intelligence, and digital health solutions into healthcare systems, which entails researching these technologies' efficacy, scalability, and moral implications (Morrow et al., 2023; Zahlan et al., 2023).

Smart Cities and Sustainable Urban Development: With a growing focus on sustainability and climate action, research may explore how innovative city technologies can be optimised for environmental conservation and resilience, considering the health impacts of urban design (Ahad et al., 2020; Albahri et al., 2023).

Human-Centred Design for Well-being: There is a persistent emphasis on human-centred design principles, guaranteeing that built environments and technologies are customised to fulfil people's various needs and preferences, focusing on mental health and well-being (Ahad et al., 2020; Bibri, 2021; Wu et al., 2022).

Inclusive Technologies and Accessibility: Research will likely address the inclusivity of technological solutions and built environments, emphasising accessibility for all individuals, regardless of physical abilities or health conditions (Bricout et al., 1 CE; Eisenberg & Maisel, 2020; Moore et al., 2023).

Health Equity and Social Determinants: Future research would seek to comprehend and mitigate the impact of socioeconomic factors on health outcomes through technological and environmental interventions. As a result, efforts to address health disparities and the social determinants of health (SDOH) may increase (Gómez et al., 2021; Townsend et al., 2020; Woodward et al., 2021).

Preventive and Personalised Healthcare: Continued exploration of preventive and personalised healthcare, leveraging technologies for early detection, intervention, and personalised treatment plans, contributing to a shift from reactive to proactive healthcare models, is another growing trend that would persist within the SDGs' concluding seven years (Alowais et al., 2023; Harry, 2023; Rana & Shuford, 2024; Rasool et al., 2023).

Ethical Use of Health Data: Research will also likely focus on the ethical collection, storage, and use of health data, considering privacy concerns, security measures, and the responsible handling of sensitive information in the context of technology and health research. In addition to exploring the intersections of technology and health research, new research endeavours would delve into the ethical dimensions surrounding collecting, storing, and utilising health data. This ethical scrutiny becomes paramount as advancements in technology enable the generation of vast amounts of health-related information. Researchers will likely emphasise protecting individuals' privacy rights throughout the research lifecycle by addressing the ethical implications of data collection processes. Addressing privacy concerns will involve implementing robust security measures to protect sensitive health data from unauthorised access or breaches.

Furthermore, responsible handling of this information becomes a focal point, encompassing transparent communication with individuals about data usage, seeking informed consent, and establishing stringent data governance protocols. Ethical considerations in health data extend beyond the immediate research context to encompass broader implications for individual autonomy, trust in technology, and the overall societal impact of data-driven health research. As technology continues to evolve, the ethical framework surrounding health data becomes integral in shaping the trajectory of responsible and impactful health research practices (Morley et al., 2020; Nittari et al., 2020; Vandemeulebroucke et al., 2022; World Health Organisation, 2021).

Community Engagement and Empowerment: Examining how technology and the built environment can empower communities, fostering active participation in health initiatives, urban planning, and decision-making processes is a growing built environment-related concern in research (Agboola & Tunay, 2023; Chau & Jamei, 2021).

Global Health Challenges and Preparedness: Given the COVID-19 wake-up call, there are growing considerations on global health challenges. Research may leverage technology and design resilient built environments to enhance preparedness for pandemics, climate-related health risks, and other emerging threats (Laaser et al., 2023; Olliaro & Torreale, 2022).

Policy and Governance Frameworks: Policy frames the environment where all human intervening activities occur. Research in these concluding phases on the SDGs would, of necessity, focus on consolidating existing and developing practical policy frameworks and governance structures to guide the responsible deployment of technology and the planning of built environments to achieve health-related goals (Lau et al., 2023; World Health Organisation, 2020; World Health Organization, 2021).

Conclusion

Understanding and navigating technological implications require ongoing research, ethical considerations, and the development of policies and interventions that harness the positive aspects of technology while mitigating potential negative consequences for the social and psychological dimensions of health.

The ten identified themes in this article highlight the multidimensional nature of the health, technology, and built environment nexus, emphasising the interconnectedness of physical, social, and technological factors in shaping the well-being of individuals and communities.

In addition, as the Sustainable Development Goals (SDGs) wrap up, researchers will likely align their efforts with the broader global agenda, seeking innovative and impactful solutions at the intersection of health, technology, and the built environment to contribute to sustainable development and improved well-being.

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