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**Revisiting Public Open Space and Physical Activity: What We Know, What We
Still Don't, and Emerging Issues—A Decade Later**

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Revisiting Public Open Space and Physical Activity: What We Know, What We Still Don't, and Emerging Issues—A Decade Later

Abstract

Public open spaces provide settings for physical activity, but research on their role continues to develop. A decade ago, a paper published by Koohsari et al. (2015) in *Health & Place* identified key conceptual and methodological challenges in public open spaces and physical activity research. Since its publication, the paper has been widely cited, with over 340 citations and a field-weighted citation impact of 10.70 (Scopus). The current interdisciplinary commentary revisits the original study, evaluates progress over the past decade, and discusses emerging issues. While some conceptual and methodological gaps have been addressed, challenges remain. Emerging issues such as intensifying climate change, pandemics, and technological shifts continue to shape how public open spaces influence physical activity. Further interdisciplinary studies among urban design science, parks and recreation, geography, public health, and other relevant fields are needed to address these challenges.

Key words: Urban design, Parks, Public health, Walking, Urban form, Built environment.

1 Introduction

Public open spaces support active behaviours by providing spaces for walking, exercise, and recreation (Bedimo-Rung et al., 2005). Nearly a decade ago, a paper published in *Health & Place* by Koohsari et al. (2015) explored the relevance of public open spaces for promoting physical activity and examined limitations in the existing literature. Briefly, the paper synthesised interdisciplinary evidence, discussed key conceptual and methodological shortcomings, and outlined a research agenda to advance science-based understanding of public open spaces and physical activity. It adopted a narrative approach to integrate evidence across disciplines and developed a conceptual framework linking public open spaces to physical activity behaviours. Since its publication, the paper has been widely recognised, with a field-weighted citation impact of 10.70 (Scopus). It has accumulated over 340 citations, ranking in the top 1% of the Social Sciences, General field (Web of Science), with these citations spanning 60 countries and 20 disciplines. Moon and Pearce (2020) identified it as one of the twelve *Health & Place* papers from 2014-2018 cited over four times the journal's average.

New empirical findings and methodological advances have addressed some challenges described in the 2015 paper. At the same time, emerging challenges, such as intensifying climate change, pandemics, and technological advancements, necessitate a reassessment of the issues identified previously. A decade after the original paper, this interdisciplinary paper—authored by scholars from diverse fields, including urban design, public health, geography, and park studies—aims to evaluate the progress made in addressing these challenges. It also identifies persisting gaps and highlights emerging issues to inform future research.

2 Revisiting key issues: progress and persisting gaps

Koohsari et al. (2015) categorised challenges in public open space and physical activity research into two areas: conceptual and methodological. This section examines the progress made and remaining gaps.

2.1 Conceptual issues

Koohsari et al. (2015) identified three conceptual issues: inconsistent definitions, causal inference challenges, and limited focus on non-residential public open spaces. A universal definition has yet to be established, although some frameworks have attempted to provide clarification, particularly in Europe (Pattacini, 2021). However, cultural and institutional variations in defining parks and other public open spaces continue to challenge standardisation. Without a clear definition, comparing studies, synthesising findings, and developing guidelines for urban design science remain difficult. Some argue that a universal definition of public open spaces is unnecessary and that studies should simply report the specific types of public open spaces they include (Lamb et al., 2019). While transparency in reporting is important, this approach raises a fundamental issue: how can subtypes be classified if the broader concept itself lacks definition? For example, in clinical medicine, researchers do not classify cardiovascular diseases—such as coronary artery disease and heart failure—without first defining cardiovascular disease (European Commission, 2021). Similarly, a consistent definition of public open space is needed, before its subtypes can be determined. It also remains unclear whether indoor public spaces, such as transit stations and shopping centres, should be considered part of public open spaces or conceptualised separately (i.e., whether “open” refers to outdoor settings, indoor

settings, or broad accessibility). Further work is needed to determine whether definitions of public open spaces should consider the types of physical activity they support—such as walking, light, moderate, and vigorous activities—and whether these definitions should differ across age groups. As a step toward this, examining existing studies on public open space subtypes may help identify commonalities and support the development of a clearer and more universal definition.

Several longitudinal studies over the past decade have strengthened evidence linking public open spaces to physical activity (Poppe et al., 2022; Schultz et al., 2017; Yi et al., 2021). However, as with broader research on urban environment and health, establishing causality remains challenging. Randomised controlled trials — the gold standard for causal inference — are impractical due to ethical and logistical constraints, as individuals cannot be randomly assigned to neighbourhoods. Instead, researchers rely on natural experiments, such as park renovations (Paudel et al., 2024; Veitch et al., 2021), but these often lack the controlled conditions for definitive causal conclusions. Another challenge is distinguishing the effects of public open spaces from other built environment factors. While research can adjust for confounders such as neighbourhood walkability and safety concerns (Juul and Nordbø, 2023; Liao et al., 2022), interactions among factors complicate this process. Addressing these limitations requires more robust natural experiment designs, advanced causal inference techniques, and longer follow-up periods (enough to capture sustained behavioural changes).

Koohsari et al. (2015) identified limited focus on public open spaces in non-residential settings as the final conceptual issue. Since then, studies have explored how such spaces promote movement throughout the day in workplaces and commercial

districts (Liu et al., 2020; Yin et al., 2023). However, they also serve as places for temporary rest and recovery (Colley et al., 2016). Further research should explore how to design them to support both physical activity and diverse user needs.

2.2 Methodological issues

Koohsari et al. (2015) identified several methodological challenges including context-free physical activity measures, inconsistent proximity definitions, and non-standardised assessments of public open space quality. Research on measuring public open space-related physical activity has progressed, with more studies using global positioning system (GPS) and accelerometers to capture movement patterns and intensity (Vich et al., 2021; Zhai et al., 2021). Big data and mobile phone data have also been used to assess context-specific park use (Rout and Nesbitt, 2024; Wei et al., 2023). However, distinguishing activity types (e.g., walking versus sitting) and integrating GPS with accelerometers involves several difficulties, such as matching data, classification errors, and accuracy issues (Katapally et al., 2020). Privacy concerns further limit GPS data use in health and built environment research (Apte et al., 2019). Proximity measurement has advanced with greater access to freely available geographic information systems maps (Spangler et al., 2023). Space syntax techniques have increasingly captured the topological aspects of public open space proximity (Chiang and Li, 2019; Tannous et al., 2021). However, debate continues over whether perceived or objectively measured accessibility better predicts physical activity (Orstad et al., 2017).

Furthermore, research on public open space quality has expanded with more studies combining objective and perceived measures of public open space attributes

(Kaczynski et al., 2020; Lorenzo et al., 2023). However, no standardised framework exists to identify the attributes that support physical activity, partly due to the lack of a universal definition of public open space. Without a clear definition, measurement criteria remain inconsistent. The rise of artificial intelligence (AI) has advanced public open space measurement by automating activity detection, refining accessibility analysis, and integrating diverse data sources (Gravitz-Sela et al., 2025; Xiao et al., 2024). However, at this stage, the application of AI remains limited by computational demands, data processing constraints, and the need for high-quality training datasets to improve accuracy.

Koohsari et al. (2015) identified three more methodological issues: accounting for the surrounding built environment, user variations, and defining effective public open space thresholds. Some studies have examined how the broader built environment, including street connectivity, land-use mix, and urban form, influences public open space use (Chuang et al., 2022; Park, 2020). However, more research is needed to define the surrounding built environment in terms of size, key attributes, and its influence on physical activity. Since 2015, many studies have examined how different public open space types support varying physical activity behaviours based on user attributes such as age, gender, and socioeconomic status (Huang et al., 2020; Mak and Jim, 2019). However, a remaining challenge is identifying common public open space attributes that promote physical activity across diverse sociodemographic groups. The identification of thresholds for public open space attributes has also been explored, with studies attempting to define the minimum distance to a park or the total number of parks within a certain distance that support physical activity (Hooper et al., 2018; Schipperijn

et al., 2017). Yet, determining what is appropriate remains difficult, as fixed thresholds may not be suitable across different urban contexts. Parametric urban design may offer a potential solution by shifting from rigid thresholds to adaptive spatial configurations (Koohsari et al., 2025). Further studies can explore how to use a parametric urban design approach in (re)designing public open spaces to support physical activity.

3 Emerging issues in public open spaces and physical activity research

Beyond the identified issues in Koohsari et al. (2015), some challenges have intensified and new ones have emerged in public open spaces and physical activity research.

3.1 Intensifying climate change and the resilience of public open spaces for physical activity

Intensifying climate change threatens the role of public open spaces in supporting physical activity. Extreme weather events, shifting seasonal patterns, and climate-related disasters such as floods and wildfires can make public open spaces unusable. In snow-heavy regions, public open spaces may become inaccessible for months, while intensifying heatwaves can make outdoor exercise risky. Several studies have examined these climate-related impacts on public open space usage (Foshag et al., 2020; Huang et al., 2023; Liang and Leng, 2025; Villaverde et al., 2024). However, these studies are mostly isolated and focus on specific climate events. There is a need to consolidate evidence and provide context-specific insights on how multiple climate change events collectively impact public open spaces. Meanwhile, public open spaces can support resilience to intensifying climate change. They can provide neighbourhood

settings for cooling and shade, as urban areas experience hotter, wetter, and more polluted conditions (Aram et al., 2019).

3.2 Pandemics and their lasting impact on physical activity in public open spaces

Pandemics have reshaped how public open spaces are used for physical activity. When indoor physical activity facilities are inaccessible or considered unsafe, public open spaces can provide important opportunities for recreational physical activity (Venter et al., 2020). Lower transmission risks in outdoor settings compared with indoor environments further increase public open spaces importance. For example, COVID-19 highlighted the role of public open spaces for residents' mental health (Lanza-León et al., 2023), yet restrictions and crowding concerns altered patterns of use (Florindo et al., 2023; Ugolini et al., 2020). It is uncertain how public open spaces should be designed and managed to support an active lifestyle while balancing health measures for future pandemics.

3.3 Unintended health consequences of public open spaces

While public open spaces support physical activity, they may also pose health risks. Overcrowding in public open spaces can reduce available space for movement and increase psychological stress (Koohsari et al., 2024). Air pollution from nearby traffic may further expose public open spaces users to harmful pollutants and increase respiratory and cardiovascular risks (Cadena et al., 2023). Noise pollution from crowds or traffic can further reduce the mental health benefits of these spaces (Zhu and Chen, 2023). Additionally, seasonal pollen release from certain plant species may trigger allergies (Cariñanos et al., 2017). The presence of urban wildlife, such as disease-

carrying insects, may also pose health risks (Heinisch et al., 2023). Leaf litter and stormwater runoff can create environmental and pollution-related health risks (Selbig, 2016). Some urban design strategies may intensify these health risks. For example, expanding open areas to encourage exercise can reduce tree cover, leading to increased air pollution exposure, higher noise levels, and greater heat stress. Future studies are needed to identify which attributes can maximise physical activity while minimising adverse health effects of public open spaces.

3.4 The commercialisation of public open spaces and its implications for physical activity

There have been several cases where public open spaces incorporate privatised amenities, paid access areas, and commercial programming, which may shape how and by whom these spaces are used (Mohamed et al., 2024; Smith, 2018, 2019). While commercialisation can enhance maintenance and programming, it may also create barriers to free and spontaneous physical activity, particularly for lower-income groups. Additionally, public open spaces designed mainly for commercial purposes may prioritise passive, consumer-oriented activities instead of active movement. Further research is needed to examine how commercialisation affects the accessibility, equity, and function of public open spaces for physical activity.

3.5 Nighttime and temporary public open spaces: new opportunities for physical activity

Public open spaces are typically studied in daytime contexts, but nighttime and temporary spaces present new opportunities for physical activity (Elshater and

Abusaada, 2022; Salvo et al., 2017). Extended hours and improved lighting can encourage activity after dark, yet research on how nighttime environments influence physical activity remains limited. Similarly, temporary spaces —such as pop-up parks and play streets— offer flexible movement opportunities but have not been widely studied in relation to sustained physical activity engagement (Prochnow et al., 2022; Winter et al., 2020). Further research is needed to understand their function, beneficiaries, and integration into long-term urban design to support physical activity.

3.6 The metaverse and the uncertain future of physical public open spaces for physical activity

The rise of the metaverse introduces uncertainties about the future of physical public open spaces and their role in physical activity. Virtual reality now creates digital public open spaces for simulated outdoor experiences (Al Shawabkeh and Arar, 2024). Although visual and auditory elements can be simulated, replicating smells, textures, and other sensory experiences remains challenging in virtual environments (Bhavadarini et al., 2023; Tewell and Ranasinghe, 2024). Nevertheless, the creation of virtual public open spaces raises questions about whether virtual environments can replace real-world public open spaces for physical activity, how such a shift might alter movement behaviours, and what implications this has for urban design and public health.

4 Conclusion

Several developments have been made in both conceptual and methodological issues related to public open spaces and physical activity over the last decade.

Addressing remaining and emerging challenges requires interdisciplinary collaboration across fields such as urban design science, parks and recreation studies, geography, public health, and other relevant fields. Community involvement is also important to align public open spaces with local needs.

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