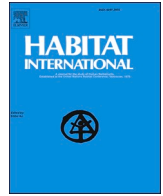


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Inclusive public open space for all: Spatial justice with health considerations

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ABSTRACT

Public open space (POS) is often regarded as a necessity that is meant to be enjoyed by everyone, especially as we move toward a post-pandemic society. It is considered one of the most crucial public health assets that contribute tremendously to people's physical, social, and psychological wellbeing. While obliging private development projects to provide POS has become a common policy for optimizing land use, some critiques regard Public Open Space in Private Developments (POSPD) as over-controlled and exclusive spaces, which raise justice concerns about people's equal rights towards POS as health resources. However, little is known about the degree to which spatial justice can be created in POSPD. With the urban population becoming more diverse, investigating POSPD's actual spatial justice situation under a robust framework to ensure access for all is timely and vital. Through the lens of spatial justice, we first examined the current dominant critiques of POSPD based on a comprehensive literature review. Using Hong Kong as a case study, we then conducted a questionnaire survey on the spatial justice performance of three representative POSPD sites and also introduced Bayesian Network as a graphical probabilistic model to illustrate the mutual relationships among key variables. The results have identified the most sensitive issues (e.g., safety, affordability and diversity), contributing to spatial justice performance and indicated that inclusive POS requires a secure, affordable environment that supports diverse activity for everyone. The findings will guide decision-makers to put the appropriate emphasis on creating and protecting inclusive POSPD in the wake of the pandemic.

1. Introduction

In densely populated cities, social inequalities have been found to have adverse effects on social sustainability (Tang, 2017). Acting as an essential dimension of social sustainability and the just city, "equity" requires a fair allocation of resources, benefits, and opportunities among the public (Fainstein, 2014). The pursuit of equity, or spatial justice for its evident spatial attribute, responds to objects of social sustainability (Talen, 2002). As one of the essential land-use types and health resources, open space remains one such valuable resource to be more than important to be arranged in a just way (Wang & Lan, 2019), especially as we move toward a post-pandemic society.

Public Open Space (POS), broadly defined, is a type of open place where people can go and just be, a physical location in which public

activities occur. It is a general conception that POS distinguish itself from the aspects of access, surveillance, behavior and usage control, and is supposed to be open to the public indistinguishably and shared by all members of the area (Landman, 2016; Jian et al., 2020). In the past few years, research on POS has been widened in multiple directions. POS has been widely recognized as a valuable health resource that moderates the deleterious effects brought by the concrete forest and should be equally enjoyed by everyone (Skinner & Masuda, 2013). Researchers have highlighted numerous observable factors that associate POS with encouraging physical activities, such as accessibility (McCormack et al., 2010), perceived proximity (Tinsley et al., 2002), maintenance, and perceived safety (Powell et al., 2003). Larger POS with good spatial quality and amenities was confirmed to be positively linked with higher levels of walking (Giles-Corti et al., 2005). Scholars reveal its

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indispensability to people’s health and wellbeing by emphasizing the chance POS provided to carry outdoor activities (Yung et al., 2016a), assessing its management strategies to advocate for diversity and inclusion (Németh, 2009), and advocating the promotion of health equity through expanding equal access to POS for different ages stratum, especially as we are moving toward a post-pandemic society (Geary et al., 2021).

The theory of spatial justice stresses the consequential spatiality of social justice and a fair distribution of POS (Soja, 2010). The theory requires a deeper understanding of the procedures that construct the (mal) distribution and advocates that people’s equal right towards getting access to POS and participating in its dynamic production process should be equally protected (Tang, 2017; Jian et al., 2020). However, POS is being made less public and criticized from many aspects with major manifestation as “privatization” (Iveson, 2011a). “Privately-owned public open space,” or “public open space in private developments” (POSPD) in Hong Kong, emerged in major cities as one of the productions of POS’s transformation all around the world (Whyte, 1980; Ho et al., 2020). As a fait accompli, most of the POSPD have some laudable merits compared to its publicly operated counterparts: they are well-maintained, safe, and combine aesthetics and functionality (Kayden, 2005, pp. 115–140; Landman, 2016). These attributes are closely linked to health promotion and confirm the potential POSPD has to benefit health. Yet, scholars also consider POSPD as commercially invented, over-controlled, environmentally privileged, and exclusive spaces that raise spatial (in)justice concerns and lead to unavoidable health inequalities (Németh, 2009; Geary et al., 2021; Rigolon & Németh, 2018; Yoon & Srinivasan, 2015).

Throughout the exploration, this paper claims that: while “the right to the city is falling into the hands of private or quasi-private interests” (Harvey, 2003), the public-private geographies generated demonstrate a subtle play between private development and spatial justice in POSPD. However, there is much less insight into the degree to which the goal of “inclusive POS” with health considerations can be deliberately approached in POSPD. What are the roles of different social and spatial factors in the promotion of equitable access to POS? What are the relationships among those factors? There is also little empirical evidence available in compact cities concerning this research issue. As obliging private development projects to provide POS has become a common policy in many countries, having a general idea of the spatial justice

performance of POSPD is a pivotal first step to figure out the ways of creating POS for all. Identifying the most sensitive factors that impact people’s equitable right to POSPD and their interrelationships are the focus of this study. By providing a theoretical rationale for the importance of spatial justice to POS, we summarize the dominant critiques of POSPD based on a comprehensive literature review. The third section will explain the methodology adopted in this research. We exclusively focus on the case studies of POSPD in Hong Kong urban areas and adopt a questionnaire survey to obtain public opinions on the spatial justice performance of three representative POSPD. After the data analysis, issues that drive the spatial justice performance outcome are identified, and the correlational attributes of spatial justice and private development are explicated. This paper concludes on theoretical and policy implications to create inclusive POS for all through improving spatial justice performance. With reference to this study’s findings, we interpolate our discussion to the appropriate emphasis for creating, improving, and protecting inclusive POSPD for all in the wake of the pandemic.

2. Public open space and spatial justice

2.1. Public open space as a health resource

In the field of urban design, POS usually refers to both the artificial and natural open spaces that are supposed to open to the public freely. As one of the essential types of land use which provide people with opportunities to “conservation, recreation, contact with nature” in an urban context (Lynch, 1984). Places such as streets, parks, green spaces, urban plaza, waterfront promenade are all included in its category (Yung et al., 2016a). Besides its physical attribute, the term also carries with some procedural connotations which are related to public interest, opinion, action and debate that accumulated through political action and public address (Iveson, 2011). In this research, POSPD has a strong connotation of ownership and specifically refers to “an open space in private development under private management where the general public are entitled to access, use and enjoy” according to the definition of the Hong Kong Government (Dev. Bureau, 2011).

Cities derive multiple health benefits from POS. The relationships between POS and public health are backed up by years of research associating access to POS and various parameters of health outcomes and pathways (Lu, 2019; Rigolon & Németh, 2020; Geary et al., 2021). Increased exposure to POS is vital for promoting healthy physical activities. It has also been associated with higher cognitive abilities, reductions in mental pressure, and a stronger sense of community (Yung et al., 2016a; Freeman & Eykelbosh, 2020). For example, long-term interaction with POS positively points to a healthier psychological status, manifesting as improved happiness and subjective wellbeing. Exposure to green space has been extensively linked to improved sleeping quality, stress and anxiety alleviation, and reduced mental depression (Bratman et al., 2015; Zhang et al., 2020). POS opens up opportunities for spatial contacts (Krellenberg et al., 2014), the planned and unexpected encounters and interactions happened in POS help people, especially for the older group, to form a stronger sense of community and ownership (Yung et al., 2016b) and prevent social isolation (Adler & Newman, 2002).

The debate concerning people’s spatial rights to POS started to enter a new phase with the COVID-19 outbreak. During the pandemic, policies to manage POS all over the world involved precautionary closures and restrictions on activities and access (Freeman & Eykelbosh, 2020). Lockdown and social distancing policies elevated the value of POS as the urban oasis that could alleviate the negative impact of the crisis on people’s mental health (Mishra et al., 2020). These policies, however, disproportionately constrained chances for different social groups to conduct healthy outdoor activity and reduce anxiety to some extent (HOOVER & Lim, 2020), fed into existing inequalities within society, and prompted discussions about people’s equal right to health resources

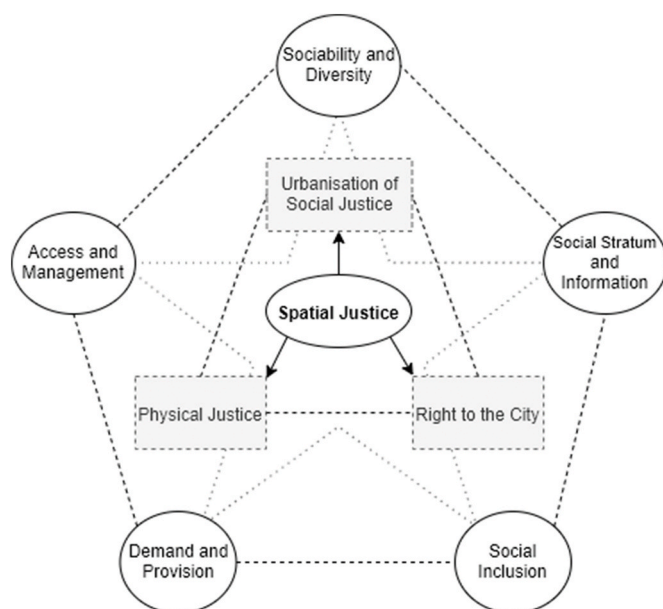


Fig. 1. Understanding Spatial Justice in POS, Source: adapted from Jian et al. (2020).

(Geary et al., 2021; Wang & Lan, 2019). The sustaining demand for POS confirms the necessity for cities to create inclusive POS for all in the aftermath of the pandemic (Freeman & Eykelbosh, 2020; Geary et al., 2021).

2.2. Understanding Spatial Justice in public open space

Spatial justice in POS advocate creating accessible and inclusive spaces for all (Jian et al., 2020). Emerged relatively late compared to other justice-related research, spatial justice is a concept whose definition has not reached a consensus yet (Pereira et al., 2017). Researchers once used the word “territory justice” (Harvey, 1973) or “social justice in space” (Pirie, 1983) to explain their research interests and reveal their emphases on spatial perspective. The theoretical underpinnings of this have led some scholars to distinguish spatial justice from the broad discussion of justice.

Among different forms of spatial injustice, two cardinal forms of spatial injustice are identified as the involuntary clustering of a certain group to a confined space (e.g., segregation) and the unfair resource allocation (Marcuse, 2009, p. 1). Meanwhile, many urban researchers have been influenced by Lefebvre’s concept of “the right to the city” and started to understand justice from distributional issues to the right to participate in the production of the city (Fainstein, 2014). Soja’s (2010) theory echoes the argument. The author elaborated spatial justice using a triangular framework that consists of three components, namely physical justice, urbanization of social justice, and right to the city (Fig. 1) and centered his critiques of injustice on the locational bias, the political organization of space, and the inequality in distributional outcomes that overlooked the production process (Iveson, 2011b).

In the context of POS, Jian et al. (2020) conducted interviews and questionnaire survey with relevant experts and professionals to quantitatively assess the nominated variables for the evaluation of spatial justice performance in POS based on Soja’s (2010) spatial justice theory. The data analysis results suggested a conceptual framework that contains five aspects and offers a direct and clear tool to quantify the spatial justice performance of POS: Access and Management, Sociability, and Diversity, Demand and Provision, Stratum and Information, as well as Social Inclusion (Fig. 1).

The conceptual framework offers an integrated insights concerning the “collective concept” spatial justice and POS planning, as well as addresses the complexity attribute of POS (Jian et al., 2020). Been identified as the most important factor, *Access and Management* draws attention to the dimension that considers the physical and locational features within and surrounds the POS. Critical variables such as Walkability, Affordability, and Safety are underscored for detailed evaluations. *Sociability and Diversity* point to the capability of POS to promote social interaction among people. Variables such as Sociability and Activity Support are included in this factor structure. *Social Inclusion* considers the disparities among different groups in terms of the provision and access to POS people’s socioeconomic backgrounds. It evaluates the extent to which a POS can provide an inclusive environment for diverse users. On the flipside, *Social Stratum and Information* as a single construct deals with the equal opportunity to participate in the process (Soja, 2010; Jian et al., 2020; Low & Iveson, 2016). The attributes under these five aspects are closely associated with health issues (Wang et al., 2021).

2.3. Spatial justice dilemmas of POSPD

Local governments in different cities have generally issued guidelines for POSPD’s space design and management. Physical characteristics, for example, the entrance, can generate powerful signals to citizens about whether they are welcomed to use the place and reflects the appropriate manner of using space in a certain cultural context (Byrne & Wolch, 2009). Some studies noted that there exists a correlation between space quality and private control. The aesthetically pleasing and

amenity-filled POSPD tend to have more onerous rules, painting a paradoxical picture of POSPD with attractiveness and conditionality at the same time (Schmidt et al., 2011).

Control in POSPD is an outward manifestation of “how form follows capital” (Hou, 2010). Despite the similarities in some regulations, such as opening hours and essential behavior control for POS in both public and private developments, managers of POSPD still have a priori ability to make exclusive rules (Németh, 2009). Usually, these rules are laden with subjectivity and uncertainty and vary among different POSPD (Schmidt et al., 2011). Some specific recreational behaviors and opportunities, such as walking the dog, skating, or making graffiti, are deemed to be less desirable, not to mention the long stay of the homeless (Rigolon & Németh, 2018). During the pandemic, some POSPD are closely indiscriminately for management convenience. Urban life can be depicted using the words “unexpected,” “spontaneous,” and “mix,” yet these rules may have created a sanitized pseudo-world with synthetic experiences (Hajer, 2001). It separates the desired, predictable public from the marginal group by its implicit or explicit exclusion (Hajer, 2001). Researchers thus hold the notion that POSPD is irreconcilable with the concept of public domain (Németh, 2009).

Exclusion from POS comes in many forms. People may be denied access to the physical space as discussed, or the public discussion process relates to changing the space (Iveson, 2011a). For an ideal POS, every citizen has equal rights to participate in the decision-making procedures concerning its production: a truly “democratic ‘public space’ ought to be open to all” (Iveson, 2011a). Yet, POSPD is not designed to facilitate the establishment and enhancement of community identity at the beginning. It does a much less effective job in terms of public participation (Talen, 2002), a vital factor that benefits people’s sense of community and psychological health (Yung et al., 2016a). Ethnic and socioeconomic disadvantages, particularly the younger generation, are ruled out procedurally during decision-making, marking their non-recognition of “being public” (Rigolon & Németh, 2018). In commercialized POSPD, people’s self-status identities may switch from citizens to consumers - the ideal users of POS, rather than citizens who hold citizenship and spatial rights (Iveson, 2011a).

There are, of course, also various voices countering the argument of POSPD’s lack of social inclusion. Regardless of its ownership, ensuring people’s rights apart from themselves take self and external disciplines. The exclusion of the “troublesome minority” would benefit the “well-behaved majority” and create a “more democratic right” to the city (Iveson, 2011a). This kind of duality presents a different scenario and rejects the conclusion that the existence of POSPD is un-democracy or reactionary to the public as a whole. It is, therefore, an important step to identify the certain factors whose absence would limit different groups’ equal spatial rights and discourage some of them from using the POSPD, to maintain its contribution to the healthiness of a city, even during an unusual period such as the pandemic.

3. Methodology

3.1. Methods

This research adopts the following conceptual and methodological approaches. For each case, several field surveys were conducted to get general ideas of our cases and developed a questionnaire to quantify people’s perceptions of a selected POSPD. Factor Analysis (FA) is conducted to reduce the number of issues and categorize them into fewer constructs. Bayesian Network (BN) is then adopted to derive and discover the interactive relationships among all items identified by factor analysis. Sensitivity Analysis is carried out to identify the most significant contributor to our final target.

3.1.1. Case selection

Adopting selected methodological approaches, we select Hong Kong urban areas as a case study to reduce contextual variability. The city is a

Table 1
Sampled POSPD.

Relevant District Council	Name	Spatial Characteristics	Type of Project	Year Opened	Area (about m ²)	Opening Hours
YAU TSIM MONG	K11 Art Mall	Passage AND Urban Plaza	Commercial	2009	1200	at all times
SHAM SHUI PO		Passage AND Urban Plaza	Residential	2014	580	at all times
WAN CHAI	Trinity Towers	Passage AND Urban Plaza/Elevated Open Deck	Residential and Commercial	2015	3321	at all times/ 8:00am–9:00pm
	The Avenue					

representative of compact morphology and offers a compelling case study for an investigation of POSPD because of its' extreme conditions of land use, centralized compact urban form, the vast population amount, and the documented green space inequities, which may lead to more obvious and dramatic conflicts (Tang, 2017).

According to the government data, up to September 2020, there are more than 80 POSPD on the record. The government classified these spaces into five types namely public green, plaza, courtyard, pocket space and promenade based on their spatial characteristics (Dev. Bureau, 2011). Among all the potential POSPD with relatively high patronage rate which is an essential precondition for data collection, the three selected cases represent POSPD have similar spatial characteristics (i.e., urban plaza) but different popularity levels.

We identified three POSPD for our empirical analysis: *Trinity Towers*, *K11*, and *The Avenue* (Table 1). The three sampled POSPD are particularly suitable to offer insights into this research for the following reasons: they are representatives of accessible core spaces for community gathering, providing facilities for relaxation and entertainment. Spaces for light activities of all ages are visible. *The Avenue*, including Lee Tung Street and the roof garden on the 5th floor, represents a high-profile space type under intensive surveillance. Thus, it more or less presents a higher level of exclusivity. While no strong demand for social segregation is observed in *Trinity Towers*, no tight private control schemes are adopted. *K11* donates a case representing an intermediate state.

3.1.2. Survey design and data collection

3.1.2.1. Questionnaire design. The questionnaire of this study is designed systematically based on identified factors and variables in the conceptual framework (Jian et al., 2020). The first part of the questionnaire adopted 34 opinion-based questions that probe perceptions of POSPD under five dimensions of the research framework. Questions concerning the performance of each variable are incorporated in the survey (Table S1 in Supplementary Materials). Each question represents one research issue. For example, issue Q15, "I feel that I do NOT need to pay or consume if I want to use this public open space," evaluates the variable "Affordability" under the dimension of the factor "Access and Management" (Low & Iveson, 2016). Respondents are asked about their

overall satisfaction with the POSPD based on the above questions. They are informed that the above questions will be used to measure spatial justice performance. The second part of the questionnaire includes six questions that reflect the survey respondents' usage habits, such as usage frequency, period of stay, and purpose (Byrne & Wolch, 2009). Respondents are required to indicate their self-assessed health levels. Users' socio-demographic and personal information is solicited for reference. Potential respondents are required to rate these questions on a five-point Likert scale.

Before conducting the survey, the questionnaire was reviewed and revised by three scholars prominent in this field and pre-tested by five scholars who are not familiar with this research area to check the estimated completion time, the appropriateness of the phrasing, legibility, and structure. In addition, wording adjustments are made for several items to enhance readability for less-educated people. This process is essential to ensure that the general public can understand the content of the question. These changes are incorporated into the final questionnaire.

3.1.2.2. Data collection. The data collection was carried out from June 2019 to January 2020, between 9:00 a.m. and 10:30 p.m. on weekdays and holidays. Also, cards with QR codes were developed. The QR code provided the link to the online version of the questionnaire, and this link was shared with potential respondents who are users of the POSPD. Participating in the survey was entirely voluntary. No incentive was included, and no reminder letter was sent to participants. The researchers attempted to ask all visitors during the survey period to maximize the sample size and get users' general demographic distribution (Ho et al., 2020).

Before explaining the survey results, here we want to highlight some limitations concerning the questionnaire and sampling. Some POS users are relatively older, relatively less educated, therefore have little ability to finish the questionnaire. Their responses are gathered primarily from the interviews. Despite the efforts we made, foreign populations, such as Southeast Asians (i.e., Filipino domestic workers) and Palestinians were underrepresented because of language restriction and their desire not to participate. Although the sample size met the analysis requirement, surveying more people could add additional insights. Ideally, the

Table 2
Profile of respondents.

Case Name	Gender	Age Group (years old)	Education	Monthly income (HKD)	Visit Frequency (Selected POSPD)
K11	Male (53.5%)	<20 (6.5%)	Primary School or Below (0%)	<17,000 (32.3%)	<1 time (72.3%)
		21–35 (1.9%)	Secondary School (16.1%)	17,000–40,000 (52.9%)	1 - 3 times (21.3%)
	Female (46.5%)	36–50 (70.3%)	University graduate or above (83.9%)	>40,000 (14.8%)	4 - 6 times (5.8%)
		51–65 (14.8%)			7 times or more (0.6%)
		>65 (6.5%)			
Trinity Towers	Male (53.7%)	<20 (0%)	Primary School or Below (19.5%)	<17,000 (57.3%)	<1 time (35.4%)
		21–35 (26.8%)	Secondary School (39%)	17,000–40,000 (34.1%)	1 - 3 times (41.5%)
	Female (46.3%)	36–50 (25.6%)	University graduate or above (41.5%)	>40,000 (8.5%)	4 - 6 times (19.5%)
		51–65 (29.3%)			7 times or more (3.7%)
		>65 (18.3%)			
The Avenue	Male (44%)	<20 (1.3%)	Primary School or Below (1.3%)	<17,000 (21.3%)	<1 time (65.3%)
		21–35 (61.3%)	Secondary School (10.7%)	17,000–40,000 (64%)	1 - 3 times (28%)
	Female (56%)	36–50 (24%)	University graduate or above (88%)	>40,000 (14.7%)	4 - 6 times (6.7%)
		51–65 (10.7%)			7 times or more (0%)
		>65 (2.7%)			

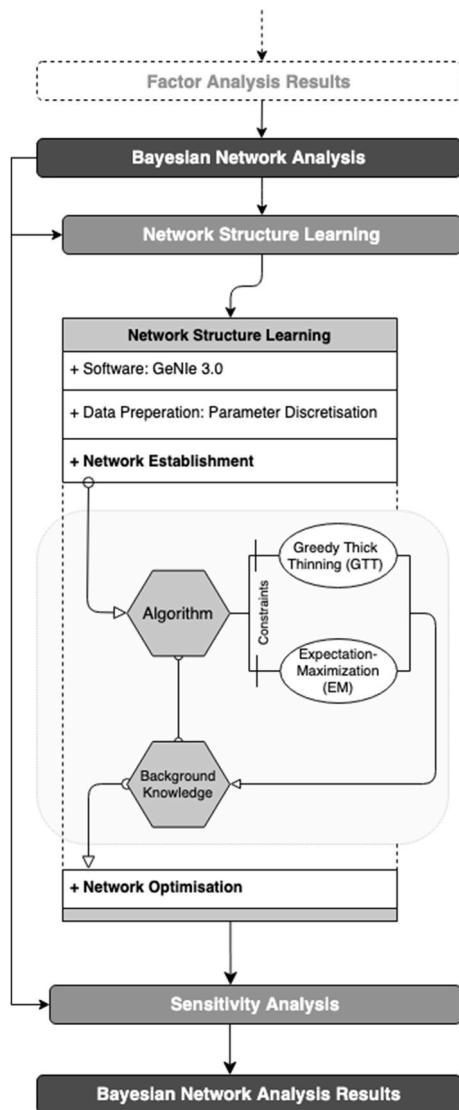


Fig. 2. Bayesian network analysis workflow.

questionnaire survey should be supplemented with interviews to offer detailed insights into the reason for respondents' grading. However, the majority of the respondents were not willing to receive our follow-up interview. In spite of the unavoidable limitations, the methods of field survey and questionnaire have been validated previously. Thus, the data could offer a reasonable basis for informed, if preliminary, conclusions about users' profiles and the spatial justice performance of the selected POSPD.

3.1.3. Profile of respondents

The survey yielded 155 valid questionnaire responses for *K11*, 82 for *Trinity Towers*, and 75 for *The Avenue*. A closer look at respondents' profile and their usage habits reveals some disparities (Table 2). The most apparent variation is the respondents' socioeconomic status (SES), especially their age groups. Around half of respondents (47.6%) for *Trinity Towers* are people who are at least 50 years old, whereas the majority of visitors in *K11* (78.7%) and *The Avenue* (86.6%) belong to the younger group (less than 50 years old). Respondents in *Trinity Towers* have a relatively low medium income compared to those in the other two cases. As for the usage habit, a relatively higher ratio of users of *K11* and *The Avenue* come to the place from their office (38.7% and 44%, respectively). These two places are more tourist attractions, and most people who come here to sightsee, consume, and participate in specific

events would not revisit them shortly. By contrast, in *Trinity Towers*, 64.6% of the respondents said they come here at least twice a week. 3.7% of the respondents visit this place almost every day to relax and kill time.

3.2. Data analysis

3.2.1. Factor analysis

We perform Factor Analysis (FA) as the model issue selection stage to lay the ground for BN analysis. This technique reduces data dimensionality into a narrower and more meaningful set of dimensions and identifies the items that best explain the corresponding dimension (de Bell et al., 2020). Preliminary correlation analysis showed that some higher-level correlations exist among the selected issues. The data was therefore deemed accurate for further analysis. The SPSS software version 25 was employed in statistical analyses. We present the FA process in *Supplementary Materials*. As a result, *K11* generates six factors with 24 issues, *Trinity Towers* has five factors with 17 issues, while *The Avenue* produced six factors containing 18 issues in total (Tables S2–S4 in *Supplementary Materials*). New factors with corresponding issues were recorded and used to construct the BN in the next step (Chan et al., 2018).

3.2.2. Bayesian Network

Bayesian Network (BN) was used for taking an event that occurred and predicting the likelihood that any one of several possible known causes was the contributing factor (Kemperman et al., 2014). GeNIe 3.0 was used to perform the BN Analysis. This well-tested software provides a graphical interface that allows for building models of any size and complexity (Jongsawat et al., 2008). Several algorithms that aid in network topological structure and parameter learning have been built into the software.

To establish the network, all issues and factors identified in the FA stage were included in the estimation. The values of the factors equal to the average scores of the relevant items (Chan et al., 2018). We calibrated the categorization of the agreement level for each question and adopted one of the most popular BN search approaches, the Greedy Thick Thinning (GTT) algorithm (Khoo et al., 2018; Fan et al., 2019), to finish the network establishment step. Fig. 2 presents the BN analysis workflow (also see *Supplementary Materials*). The learned network was optimized based on previous literature (Jongsawat et al., 2008).

3.2.3. Sensitivity analysis

In general, changes regarding issues with higher sensitive values may significantly impact the target node (Coupé et al., 2000). Sensitivity Analysis (SA) was adopted to determine the most impactful issues. It is a technique that can help validate the probability parameters and give an indication of the performance of each issue's contribution to the target node (Zhang et al., 2014; Wu et al., 2020). Because this analysis aims to search for the most critical parameters, some issue nodes were carefully removed because they did not contain any parameters that contribute to the target node's realization. In total, we recorded the ten most sensitive issues for each case (Table S5, Figure S2.1–S2.3 in *Supplementary Materials*). The significance of the findings as depicted by these figures will be discussed in the next section.

4. Findings

4.1. Correlation analysis

This section points out a few notable findings. First of all, the correlation analysis result (Table S6 in *Supplementary Materials*) confirmed previous research that more exposure to POS is positively associated with people's health status (Bratman et al., 2015). The result also reveals that if a POSPD performed better in terms of spatial justice, users tend to get more contact with it while staying longer during each visit,

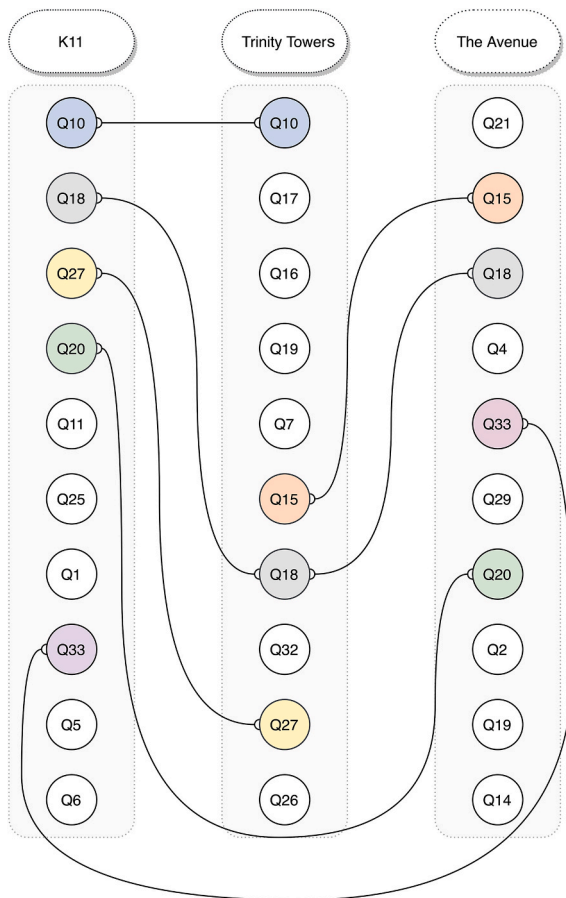


Fig. 3. Comparison of the 10 most sensitive issues identified in the sensitivity analysis.

regardless of their age and gender. Notably, in line with the arguments of Yung et al. (2016b), the elderly demonstrate a higher demand to visit POS with health considerations, especially in Hong Kong's compact context. The close association of age and time to visit POS per week underscores the necessity to create more affordable, inclusive POS as an equitable health resource for older people. This explains why people who perceived themselves to be healthier tend to appreciate the better spatial justice performance of POSPD. Users may feel the place to be affordable, safe, and themselves welcomed, and this is tightly linked to their health and wellbeing.

4.2. Sensitivity analysis

According to Fig. 5, for K11, the three leading issues that determine users perception are “NO socio-personal related issues” (Q10), “good management” (Q18) and “activity support” (Q27). Among which, “NO socio-personal related issues” (Q10) that may prevent people from using the space is the leading item. The result indicates that the users of K11, the majority of whom belong to the younger generation (Table 2), tend to enjoy a quality, safe environment that embrace diversity.

In Trinity Towers, “NO socio-personal related issues” (Q10), “travel cost” (Q17) and “travel time” (Q16) are the most sensitive three issues. The relatively older and economically-disadvantaged groups in the neighborhood yearn for a safe, affordable space that is close to where they live. It is notable that the three sensitive issues of K11, Q10, Q18, and Q27, although they are also significant issues for Trinity Towers, they have different sensitivity rankings except Q10.

While in The Avenue, “get help easily” (Q21), “no feeling of compulsory consumption” (Q15), and “good management” (Q18) are the most sensitive issues. For users of The Avenue, the majority of whom

travel longer to visit this place are not familiar with this neighborhood. Qualified assistance and guidance provided can primarily improve people's perception of spatial justice and benefit their psychological health.

4.3. Network analysis

4.3.1. Knowledge, safety concern and patrol

The network result of Trinity Towers indicates a causal relationship between people's knowledge (Q1), perceived safety when travel to the space (Q11), and concerns about socio-personal related issues (Q10) (Figure S2.1 in Supplementary Materials).

4.3.2. Expenditure, affordability and commercialization

In the case of Trinity Towers, reasonable travel time (Q16) act as a mother node and impact people's attitudes towards fares (Q17, travel cost) and consumption plans (Q15, no feeling of compulsory consumption) (Figure S2.2 in Supplementary Materials). See the affordability dimension from another angle, in The Avenue, no feeling of compulsory consumption (Q15) scores lower than the other cases (i.e., 3.09) due to its high level of commercialization.

4.3.3. Activity support, diversity, and control

Activity support (Q27) is the third sensitive aspect for K11 and also a small but influential contributor in Trinity Towers. This sensitive issue is directly linked to the ability of the POS to promote sociability (Q26), POS as a shelter for psychological restoration (Q28), and have an impact on its overall spatial justice performance (Figure S2.1 in Supplementary Materials).

Despite the fact that these three cases have different physical-social-spatial characteristics, and the dominant drivers of their spatial justice performance are quite different, we can observe some overlaps and commonalities among the factors and issues. According to the BN and SA results, common factors and issues such as safety, walkable routes, good maintenance, and activity support were sensitive to the spatial justice performance of POSPD (Fig. 3). These dimensions have also been examined by previous researchers from different perspectives (Jian et al., 2020; Sahito et al., 2020; Wang & Chen, 2018). Although one issue may belong to different factors in different cases in the FA step, in this section, they are discussed according to their essential meanings. Notably, the analysis results of BN and SA do not mean that those sensitive issues can entirely decide the spatial justice performance of a specific POSPD. Instead, the analysis techniques are to provide us with potential mechanisms to be discussed and paid more attention to. Here, we present the condensed findings that allow for commonalities among the cases to emerge.

5. Discussions and recommendations

In a nutshell, the spatial justice performance of POSPD can be approached, maintained, and enhanced by providing a secure, affordable environment that supports diverse activities for everyone.

5.1. Secure: improved knowledge and reasonable patrol

A safe environment, as a precondition for people's unexpected encounters, reinforces the sense of community and facilitates social inclusion. As our network analysis result suggests, the awareness and knowledge of the existing POSPD help people free from safety concerns in situations when they commute to and use the space. The result echoes the research of Lara-valencia and García-pérez (2015), who stated that people tend to have more knowledge of the POS if it is located within the boundary that is considered to be their neighborhood.

In both K11 and Trinity Towers, NO socio-personal related issues (Q10) that may prevent people from using the space is the leading item, yet, the emphasis on safety when promoting health in these three cases



Fig. 4. “Petit-bourgeoisie sentiments” (left) and safety guard (right) in The Avenue.

has different considerations. For instance, *Trinity Towers* is located in one of the oldest districts, Sham Shui Po, where the buildings and facilities are old, and the proportions of older people and minorities are high. Except for some small restaurants providing local food during the evening, there exists no such thing as nightlife. The improved sense of safety is, therefore, associated with the psychological health consideration, especially raising people’s concern about using POSPD after nightfall. For users of *The Avenue*, the majority of whom travel longer to visit this place are not familiar with this neighborhood. Qualified assistance and guidance provided can primarily improve people’s perception of spatial justice and benefit their psychological health.

In line with the research of [Sahito et al. \(2020\)](#), our field survey validated the existence of monitored use, constrained accessibility, and additional features employed to govern various activities in the three cases. The privatized space is usually managed through the use of surveillance and private guards. Visitors are thus more inclined to feel protected. However, it should be noted that security cameras and personnel could control crime and violate people’s right to privacy and freedom at the same time. Respondents in *The Avenue* gave relatively low scores for the items evaluating the unfortunate side effect of privatization (Q14, Q15, and Q22). This, seen from the positive side, points to a clear direction for its potential improvement.

The predominant effect of safety on people’s intention to use POS, especially for women and children, has been highlighted by various previous research ([Jian et al., 2020](#); [Yigitcanlar et al., 2020](#)). The presence or absence of a safe environment would largely influence the spatial justice performance of a POSPD. However, for a space that is already highly controlled and patrolled by the security guard, scilicet the space is already free from safety risks to a large extent, extra investment in this aspect would not lead to a corresponding improvement in terms of spatial justice performance. Space managers should take very seriously the strategies adopted to add value: provide service desk, offer information, create the feeling of intimacy and inclusion, and add “effective eyes” in the space instead of simply secure it with armed guards ([Jacobs, 1961](#)).

5.2. Affordable: for everyone’s enjoyment

From the point of psychological health in using POS, people need to have a sense of freedom and being included with affordable uses. People tend to consider their expenditure of using the POSPD from the aspects of affordable travel costs, travel time, and no feeling of force-consuming, and stress distance-based concepts such as walkable routes.

Besides the safety concern, *Trinity Towers* is most influenced by its affordability and availability. Activities happened in *Trinity Towers* in general reflect the traditional daily life of Hong Kong local people. The elderly often enjoy their meals or just sit and watch. In this high walkable but economically disadvantaged district, most people are unable to afford a private garden, nor are they willing to spend extra money or

time using another POS. The POSPD of *Trinity Towers* provides a socially-loose-controlled open space that one would be predisposed to be “free.” Once this sensitive factor has been changed, say using the place became an unaffordable activity, or the open space is unavailable, any more people value this character (e.g., the elderly, the poor) would be excluded.

Compared to its roof garden located on the fifth floor, which is more like a private garden, *Lee Tung Street* of *The Avenue* is accessible and well-known on the ground floor. *Lee Tung Street* is not gated, and there is no one to tell certain people not to enter. However, people see hints of exclusivity from its polite, upper-class atmosphere. The street shops, most of which are restaurants and retails with some “petit-bourgeoisie sentiments,” the placement and design of the chairs echo the building orientation, assisted by the transparent and translucent facades, all of these characteristics contribute to the creation of a high-end image with a thick commercial atmosphere in this particular area ([Fig. 4](#)).

Commercialization, on the one hand, offers an extra stimulus for people to look at or experience. On the other, high service prices, tight social control schemes would create a better maintained but increasingly inhospitable and unaffordable environment for the general public. In addition, people who are not well off may be unable to find a consumption site that matches their consumption attitudes. Providing affordable POS for everyone’s enjoyment matters for people’s health-related outcomes in the post-pandemic societies.

5.3. Diverse: spontaneous and adaptive environment

One major aspect of the healthy attribute of POS is that the users go there for light exercise and reasonable activities (e.g., social interaction) in a dense city where citizens, especially the older group, who generally live in small, confined spaces. Social and activity diversity in a POS combines the inherent site design (e.g., the facilities and amenities provided) and the rules and regulations adopted to manage the space.

In each case, respondents were asked to indicate the activities they were pursuing that day. The data is coincided with our field observation and show a limited form of activity: a large majority checked the box of “passive activity.” In general, the three cases enjoyed a similar low satisfaction level in terms of activity support (Q27), with *The Avenue* scored the lowest (i.e., 2.92, unsatisfactory). Only fixed chairs (with arms to prevent people from sleeping on them) are distributed in the space. Although some respondents stated that their purpose of visiting is to sit down and rest, the size and spatial design of these three POSPD do not offer further possibilities for other types of activities. The limited facilities and amenities play a significant role as the “opportunity-reduction” technique and leave the visitors few options when using the space ([Fig. 5](#)).

The accumulated evidence shows that privatizing strategies can be seen as a continuing source of tension between spontaneous social activities and managers’ control over space ([Rossini et al., 2020](#); [Wang &](#)



Fig. 5. Passive activities in K11 (top), Trinity Towers (middle), and The Avenue (bottom).

Chen, 2018). Direct control instruments (e.g., security cameras and personnel) are visible in all three cases but not very sensible in *Trinity Towers*. Concerning the POS regulations, lengthy and complicated regulations are posted at every entry of *The Avenue*, while no subjective or judgment rules are found in *K11* and *Trinity Towers*. Regulations of *The Avenue* aim to narrow the accepted behavioral norms further. Distinctions between “decent” and “indecent” behaviors are defined vaguely: distribute notice, play music, or any games or strange behaviors that may inflict others are on the restriction list (Fig. 6).

One commonly recognized explanatory mechanism is that POSPD developers devote efforts to improve its spatial quality and build a “highly-Instagrammed” environment driven by their profit-chasing nature, as stated in the previous section (Yoon & Srinivasan, 2015). This would inevitably lead to a lack of specificity and diversity and the failure to adapt to different user preferences. Management schemes that

advocate loosen control and improve activity support to create spontaneous and adaptive environment should be adopted to share the privilege of creating and interpreting the connotation of the POSPD with all users, further facilitate the overall spatial justice performance.

5.4. Limitation and future research

Analogous to other urban-related research, we want to point out some limitations encountered. Despite the fact that we did not encounter any difficulty when conducting the survey with the public, the survey process could benefit from a pilot study with the aid of the laymen. Since this study is conducted in Hong Kong, the results may not be applicable to other context that do not share similar political or socioeconomic backgrounds with Hong Kong. Similar studies could be conducted in such regions using this study as a reference. Besides the consideration



Fig. 6. Public open space regulations in K11 (left), Trinity Towers (middle), and The Avenue (right).

and efforts dedicated to facilitating a more equitable distribution of POS, the results corroborate POSPD a need for policies and funding schemes to encourage more explorations of ways to balance spatial justice and private power so that this valuable health resources would be enjoyed by everyone. Future research is recommended to dive into the ways people decipher a POSPD to be exclusive through the combination of novel psychological research. Empirical validation of the results in another context (e.g., a flat city) with careful interpretation is also recommended. Spatial justice does not necessarily lead to liveability, but we claim that it is the prerequisite for a better quality of healthy life. Future study could validate this argument and conduct in-depth interview to find out the underlying dynamics.

6. Conclusion

The common POSPD policy worldwide embraces the contribution from the private developers to benefit most people. POSPD, especially those attached to shopping malls, are gradually taking the place of traditional open spaces as social centers in contemporary cities with evolving consumption and leisure patterns (Rossini et al., 2020; Sahito et al., 2020). *The Avenue*, and *K11*, are this recognized destination-type POSPD that attract visitors beyond the immediate community. The privatized public realm pictures a scene where inclusion co-presence with exclusion generates new tension between spatial justice and private development and demands new perspectives when creating inclusive POS for all in post-pandemic cities.

This research adopts a conceptual framework of spatial justice in POS and carefully examines three POSPD cases in the compact city context to determine the most sensitive issues for improving spatial justice performance with a particular focus on the aspects contributing to a healthy city. The results highlight the critical roles that *safety*, *affordability*, and *diversity* play in facilitating the spatial justice performance of POSPD, identify them as the most sensitive issues that require extra attention when building an inclusive POSPD, as well as highlight the relationships between these vital aspects and different dimensions of private development, which advise the ways in which we can secure these sensitive issues. As our research result suggests, besides prioritising the efforts of ameliorating the most sensitive issues (i.e., safety, affordability and diversity) directly, the spatial justice performance of POSPD can also benefit from enhancing people's knowledge and understanding about the available POSPD in their close proximity, carefully reducing the expenses of using the space, and an improved activity support level which could lead to a spontaneous and adaptive environment so to approach the goal of promoting health and wellbeing.

The issue of privatization is not unique to Hong Kong. Emergencies like COVID-19 also indicated that accessible open spaces were still

regarded as a “privilege” instead of a “basic right,” which is supposed to be. POSPD that were closed and reserved to serve residents only intensifies the spatial injustice in the society. This suggests a necessity to link POS, especially those in private developments, with the keyword “inclusive” to prepare and respond to an emergency. As the extant studies have concerned, aspects such as spatial justice, management of POS do not have ideal templates for the stakeholders to copy.

While the previous literature has the tendency of demonising POSPD as a product of privatization and neoliberalism, seeing POSPD as a contradiction of public domain, the results of this research indicate that spatial justice and private development can work in tandem to build a new type of publicness in this relatively novel POS and benefit people's health. Our findings call for an introspection of the relationship of public and private stakeholders of building an inclusive POSPD and could serve as a starting point for a deeper exploration of context-based tensions in the POSPD of global cities that aspire to be health cities.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.habitatint.2021.102457>.

CRediT authorship contribution statement

Izzy Yi Jian: Conceptualization, Writing - original draft, Methodology, Data curation, Formal analysis, Writing - review & editing. Edwin H.W. Chan: Writing - review & editing, Supervision. Yang Xu: Resources, Writing - review & editing, Supervision. Emmanuel Kingsford Owusu: Resources, Writing - review & editing.

References

- Adler, N. E., & Newman, K. (2002). Socioeconomic disparities in health: Pathways and policies. *Health Affairs*, 21, 60–76.
- Bratman, G. N., Daily, G. C., Levy, B. J., & Gross, J. J. (2015). The benefits of nature experience: Improved affect and cognition. *Landscape and Urban Planning*, 138, 41–50.
- Bureau, D. (2011). *Public open space in private developments design and management guidelines*. Hong Kong.

- Byrne, J., & Wolch, J. (2009). Nature, race, and parks: Past research and future directions for geographic research. *Progress in Human Geography*, 33, 743–765.
- Chan, A. P., Wong, F. K., Hon, C. K., & Choi, T. N. (2018). A Bayesian network model for reducing accident rates of electrical and mechanical (E&M) work. *International Journal of Environmental Research and Public Health*, 15, 2496.
- Coupé, V. M., Jensen, F. V., Kjørulff, U., & Van der Gaag, L. C. (2000). A computational architecture for n-way sensitivity analysis of Bayesian networks. *Technical Report*. Aalborg University.
- De bell, S., White, M., Griffiths, A., Darlow, A., Taylor, T., Wheeler, B., & Lovell, R. (2020). Spending time in the garden is positively associated with health and wellbeing: Results from a national survey in England. *Landscape and Urban Planning*, 200, 103836.
- Fainstein, S. S. (2014). The just city. *International Journal on the Unity of the Sciences*, 18, 1–18.
- Fan, L., Wang, M., & Yin, J. (2019). The impacts of risk level based on PSC inspection deficiencies on ship accident consequences. *Research in Transportation Business & Management*, 33, 100464.
- Freeman, S., & Eykelbosh, A. (2020). *COVID-19 and outdoor safety: Considerations for use of outdoor recreational spaces*. National Collaborating Centre for Environmental Health.
- Geary, R., Wheeler, B., Lovell, R., Jepson, R., Hunter, R., & Rodgers, S. (2021). A call to action: Improving urban green spaces to reduce health inequalities exacerbated by COVID-19. *Preventive Medicine*, 106425.
- Giles-corti, B., Broomhall, M. H., Knuiam, M., Collins, C., Douglas, K., Ng, K., Lange, A., & Donovan, R. J. (2005). Increasing walking: How important is distance to, attractiveness, and size of public open space? *American Journal of Preventive Medicine*, 28, 169–176.
- Hajer, M. A. (2001). *Search of new public domain: Analysis and Strategy*. Rotterdam: NAI Publishers.
- Harvey, D. (1973). *Social justice and the city*. Johns Hopkins University Press.
- Harvey, D. (2003). The right to the city. *International Journal of Urban and Regional Research*, 27, 939–941.
- Ho, D. C., Lai, L. W., & Wang, A. (2020). The effects of ‘publicness’ and quality of publicly accessible open space upon user satisfaction. *Environment and Planning B: Urban Analytics and City Science*, 2399808320903733.
- HOover, F.-A., & Lim, T. (2020). Examining privilege and power in US urban parks and open space during the double crises of antiblack racism and COVID-19. *Socio-Ecological Practice Research*, 1–16.
- Hou, J. (2010). *(Not) your everyday public space: Insurgent public space*. Routledge.
- Iveson, K. (2011a). *Publics and the city*. John Wiley & Sons.
- Iveson, K. (2011b). Social or spatial justice? Marcuse and Soja on the right to the city. *City*, 15, 250–259.
- Jacobs, J. (1961). *The death and life of great American cities*. New York: Random House.
- Jian, I. Y., Luo, J., & Chan, E. H. (2020). Spatial justice in public open space planning: Accessibility and inclusivity. *Habitat International*, 97, 102122.
- Jongsawat, N., Poompuang, P., & Premchaiswadi, W. (2008). Dynamic data feed to Bayesian network model and SMILE web application. In *2008 Ninth ACIS International conference on software engineering, artificial intelligence, networking, and parallel/distributed computing* (pp. 931–936). IEEE.
- Kayden, J. (2005). *Using and misusing law to design the public realm*. Regulating place: Standards the shaping of urban America.
- Kemperman, A., Timmermans, H. J. L., & Planning, U. (2014). Green spaces in the direct living environment and social contacts of the aging population. *Landscape and Urban Planning*, 129, 44–54.
- Kho, H. L., Ahmed, M. J. A. A., & Prevention. (2018). Modeling of passengers’ safety perception for buses on mountainous roads. *Accident Analysis & Prevention*, 113, 106–116.
- Krellenberg, K., Welz, J., & Reyes-päcke, S. (2014). Urban green areas and their potential for social interaction—A case study of a socio-economically mixed neighbourhood in Santiago de Chile. *Habitat International*, 44, 11–21.
- Landman, K. (2016). Shopping malls with quasi-public spaces in Pretoria: Neo-traditional consumption space or controlled village commons? *Town and Regional Planning*, 69, 26–38.
- Lara-valencia, F., & García-pérez, H. (2015). Space for equity: Socioeconomic variations in the provision of public parks in Hermosillo, Mexico. *Local Environment*, 20, 350–368.
- Low, S., & Iveson, K. (2016). Propositions for more just urban public spaces. *City*, 20, 10–31.
- Lu, Y. (2019). Using Google Street View to investigate the association between street greenery and physical activity. *Landscape and Urban Planning*, 191, 103435.
- Marcuse, P. (2009). *Spatial justice: Derivative but causal of social injustice*. Justice spatiale/spatial justice.
- Mccormack, G. R., Rock, M., Toohey, A. M., & Hignell, D. (2010). Characteristics of urban parks associated with park use and physical activity: A review of qualitative research. *Health & Place*, 16, 712–726.
- Mishra, S. V., Gayen, A., & Haque, S. M. (2020). COVID-19 and urban vulnerability in India. *Habitat International*, 103, 102230.
- Németh, J. (2009). Defining a public: The management of privately owned public space. *Urban Studies*, 46, 2463–2490.
- Pereira, R. H., Schwanen, T., & Banister, D. (2017). Distributive justice and equity in transportation. *Transport Reviews*, 37, 170–191.
- Pirie, G. H. (1983). On spatial justice. *Environment & Planning A*, 15, 465–473.
- Powell, K. E., Martin, L. M., & Chowdhury, P. P. (2003). Places to walk: Convenience and regular physical activity. *American Journal of Public Health*, 93, 1519–1521.
- Rigolon, A., & Németh, J. (2018). Privately owned parks in new urbanist communities: A study of environmental privilege, equity, and inclusion. *Journal of Urban Affairs*, 40, 543–559.
- Rigolon, A., & Németh, J. (2020). Green gentrification or ‘just green enough’: Do park location, size and function affect whether a place gentrifies or not? *Urban Studies*, 57, 402–420.
- Rossini, F., & Yiu, M. H.-L. (2020). Public open spaces in private developments in Hong Kong: New spaces for social activities? *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, 1–25.
- Sahito, N., Han, H., Nguyen, T. V. T., Kim, I., Hwang, J., & Jameel, A. (2020). Examining the quasi-public spaces in commercial complexes. *Sustainability*, 12, 1830.
- Schmidt, S., Nemeth, J., & Botsford, E. (2011). The evolution of privately owned public spaces in New York City. *Urban Design International*, 16, 270–284.
- Skinner, E., & Masuda, J. (2013). Right to a healthy city? Examining the relationship between urban space and health inequity by Aboriginal youth artist-activists in winnipeg. *Social Science & Medicine*, 91, 210–218.
- Soja, E. W. (2010). *Seeking spatial justice*. U of Minnesota Press.
- Talen, E. J. H. P. D. (2002). The social goals of new urbanism. *Housing Policy Debate*, 13 (1), 165–188.
- Tang, B.-S. (2017). Is the distribution of public open space in Hong Kong equitable, why not? *Landscape and Urban Planning*, 161, 80–89.
- Tinsley, H. E., Tinsley, D. J., & Croskeys, C. E. (2002). Park usage, social milieu, and psychosocial benefits of park use reported by older urban park users from four ethnic groups. *Leisure Sciences*, 24, 199–218.
- Wang, Y., & Chen, J. (2018). Does the rise of pseudo-public spaces lead to the ‘end of public space’ in large Chinese cities? Evidence from Shanghai and Chongqing. *Urban Design International*, 23, 215–235.
- Wang, R., Feng, Z., Pearce, J., Zhou, S., Zhang, L., & Liu, Y. (2021). Dynamic greenspace exposure and residents’ mental health in Guangzhou, China: From over-head to eye-level perspective, from quantity to quality. *Landscape and Urban Planning*, 215, 104230.
- Wang, Q., & Lan, Z. (2019). Park green spaces, public health and social inequalities: Understanding the interrelationships for policy implications. *Land Use Policy*, 83, 66–74.
- Whyte, W. H. (1980). *The social life of small urban spaces*. Washington DC.
- Wu, Z., Shen, Y., Wang, H., & Wu, M. (2020). Urban flood disaster risk evaluation based on ontology and Bayesian Network. *Journal of Hydrology*, 583, 124596.
- Yigitcanlar, T., Kamruzzaman, M., Teimouri, R., Degirmenci, K., Alanjagh, F. J. L., & Planning, U. (2020). Association between park visits and mental health in a developing country context: The case of Tabriz, Iran. *Landscape and Urban Planning*, 199, 103805.
- Yoon, H., & Srinivasan, S. J. U. A. R. (2015). Are they well situated? Spatial analysis of privately owned public space, Manhattan, New York city. *Urban Affairs Review*, 51 (3), 358–380.
- Yung, E. H., Conejos, S., & Chan, E. H. (2016a). Public open spaces planning for the elderly: The case of dense urban renewal districts in Hong Kong. *Land Use Policy*, 59, 1–11.
- Yung, E. H., Conejos, S., & Chan, E. H. (2016b). Social needs of the elderly and active aging in public open spaces in urban renewal. *Cities*, 52, 114–122.
- Zhang, L., Wu, X., Skibniewski, M. J., Zhong, J., & Lu, Y. (2014). Bayesian-network-based safety risk analysis in construction projects. *Reliability Engineering & System Safety*, 131, 29–39.
- Zhang, J., Yu, Z., Zhao, B., Sun, R., & Vejre, H. (2020). Links between green space and public health: A bibliometric review of global research trends and future prospects from 1901 to 2019. *Environmental Research Letters*, 15, Article 063001.