Chapter 8
Relationships Between Urban Green Areas and Health in China, Brazil and the UK

Klaus C. Alberto, Loyde A. Harbich and Ying Li

Abstract This chapter discusses the interactions between green areas and health in China, Brazil and the UK, which have a potential towards improving health in general, especially because the quality of those spaces promotes walkability. The understanding of this interrelationships in different geographic contexts is important to promote modifications on urban planning focused to improve features of green urban areas. This chapter proposes different approaches and experiences about importance of greening on human health by existent researches. In general, methods used in studies about the relations between green infrastructure and health based on health measures, interviews and environmental data. It suggests that promote greenery as forestry, squares, parks, backyards or frontal yards, related to better overall health.

8.1 Introduction

Relations between the natural and built environment and health have been addressed from different fronts in recent decades (United Nations Human Settlements Programme 2016). There is a consensus that increasing urbanization poses challenges for both urban planning and health (Rydin et al. 2012; Dye 2008). In a context of declining green areas in cities, studies of these areas and their impact on health have been one of the most explored themes.

K. C. Alberto (✉)
Graduate Program of Built Environment, School of Architecture and Urbanism, Federal University of Juiz de Fora, Juiz de Fora, Brazil
e-mail: klaus.alberto@ufjf.edu.br

L. A. Harbich
Graduate Program of Cities and Design, School of Architecture and Urbanism, Federal University of Goiás, Goiânia, Brazil
e-mail: loydeabreu@gmail.com

Y. Li
School of Architecture, Tianjin University, 92 Weijin Road, Nankai District, 300072 Tianjin, China
e-mail: liyinglandscape@gmail.com

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The number of studies in this field has increased in recent decades, including the production of literature reviews (Van den Berg et al. 2015; Nieuwenhuijsen et al. 2017; Lee and Maheswaran 2011). This subject has been further disseminated through reports produced by official bodies. Through the World Health Organization, the United Nations published the report entitled "Urban green spaces and health: a review of evidence", (WHO 2016). This document consolidates the results of other reviews that had been partly developed on the topic in other publications of this institution (WHO 2010, 2013). Currently, one of the United Nations Sustainable Development Goals is the access to urban green areas to the population, especially the most vulnerable (UN SDGs 2015).

It is not known all the explanatory mechanisms of the health benefits of green areas for the urban population. However, there is a significant body of evidence pointing to a positive correlation in some areas of research. In this sense, we highlight studies indicating that green areas can reduce cases of cardiovascular morbidity and type 2 diabetes; improve mental health; increase social contact; stimulate physical activity; and contribute to obesity reduction, among other factors.

The purpose of this chapter is to comprehend how the research developed in China, Brazil and the UK approach the relations between urban green areas and human health. The scientific production in three continents, here represented by the three countries mentioned, provides a multicentric point of view that allows us to observe similarities and differences in the research perspectives and results.

Papers in the English language, published since 2007 in repositories of the leading scientific publications for the field under analysis, were reviewed. To this end, the keywords "urban green" and "Health" were combined with the keywords "China", "Brazil" and "UK". This review focused on the correlations between green areas and health, the used methods, the scale of the investigation (e.g. cities, neighbourhood, parks) and the key findings of these studies.

This chapter is divided into three sections that correspond to the results of the reviews in each one of the three countries and a last section that summarize the main findings of these studies.

8.2 China

In China, which is experiencing rapid urbanization, the government has become keen to build green infrastructure to deal with environmental problems. Examples include a nationwide "sponge city" programme to reduce inner-city flooding (Wokman 2017) and a "forest city" programme to improve the air quality (Phillips 2017). According to a Chinese government report: by the end of 2016 the percentage of green area in urban built-up areas reached 36.4%; the per capita green area of parks reached 13.5 m^2 per person. China's urban built-up area had a total of 1.971 million ha of green space, and the area of urban parks was 641,000 ha (China Forestry Bureau 2017). The current government assessment indicators for urban green space in China are public green space per capita, urban vegetation coverage and the urban green space

ratio. The focus is on quantitative assessment rather than on the social and economic value of urban green space (Wang and Li 2015).

The demand for green space is much higher than the supply, particularly in big cities like Shanghai (Wolch et al. 2014). Urban green space in China is seen as an environmental justice issue related to the high residential density, the historic pattern of urban development and extremely rapid urbanization (Wolch et al. 2014). A case study of Hangzhou indicated that many urban spaces are not well suited for active recreation because of their small size and lack of facilities. Even though the visual quality of the new urban parks is often pleasing, the parks are well suited for passive recreation (Chen et al. 2009). The official figure for green space in Hangzhou is 15 m^2 per capita and 90% of the city's population has easy access to urban green space (Sang et al. 2013). However, the official data does not measure the health benefits of green spaces for people. For example, there are not enough outdoor play spaces for children and parks built close to main roads and railways can easily increase the risk of exposure to air pollutants, which have a negative impact on health and well-being (Sang et al. 2013). A methodological approach focused on people is therefore needed. This approach should review the function of urban green spaces as well as quantify the area of green space in a city.

Urban landscapes should be assessed scientifically using a comprehensive approach which includes both the environmental and social factors (Wang and Li 2015). At the city scale, the assessment metrics for leisure included socio-economic, environmental and landscape indicators (Wang and Li 2015, pp 191–192). A conceptual model for assessing service levels for urban green spaces and ecosystem management was proposed by applying a user-based conceptual model which includes UGS features, population characteristics, recreational use behaviour and recreational benefits (He et al. 2016). Similarly, questionnaire methods were applied to review the positive and negative contribution of urban green spaces in Guangzhou, with public health as one of the study areas. The study with 595 respondents revealed that a contribution to health was ranked above all others factors. Significant differences in perception were found across most socio-economic variables (Jim and Shan 2013).

Recent research on the mapping of public green space accessibility in the central city of Shanghai revealed potential mismatches between public green space provision, resident visits and the demand of socially vulnerable groups. This can influence the health and well-being of society (Shen et al. 2017). The study used 12 indicators related to socio-economic status, demographics and characteristics and the urban spatial structure (Xiao et al. 2017). These indicators were used to examine the 1213 public green spaces in the study area. The areas included parks, street gardens, forests, green squares and plazas, greenways, and sports grounds. The research showed the need for empirical data to be provided to decision-makers in China to improve the socio-economic aspect of urban green space (Shanghai, Beijing, Hangzhou, etc.).

Research work in China has concentrated on physical health. Relatively little has been done on the relationship between urban green spaces and other aspects of well-being. But mental health at the neighbourhood level was studied in Beijing. The study found that having a park nearby was the only factor with a significant correlation with people's subjective well-being (Dong and Qin 2017). However, an empirical study

using 5 years of data monitoring by applying a stratified and systematic sampling method to choose 15 healthy cities in China to make another 15 unhealthy cities as the comparison group. It was found that there is very little correlation between urban health, green space and air quality (Yue et al. 2017). In summary, for future research, there is a need to develop research on the relationship between health and well-being and urban green space, particular to develop the measurement for the study on the mental health and built environment.

8.3 Brazil

The relationship between urban green spaces and human health has been studied in Brazil in recent years, where the main focus is the practice of physical activity in open public areas to prevent diseases related to a sedentary lifestyle.

Pucci et al. (2012) made a systematic review of the literature regarding this theme. Other studies used the questionnaire method, where has been different correlations such as physical activity and the distance between residence and leisure area, physical activity and the environmental quality of the urban space, perception of the quality of life and physical activity. Main questionnaires were WHOQOL (WHO) (combination of physical, psychological, social and environmental factors), International Physical Activity Questionnaire (IPAQ) (Salvador et al. 2009; Fermino et al. 2013), International Physical Activity and Environment (IPEN) (Florindo et al. 2011; Hino et al. 2017), Neighborhood Environment Walkability Scale for Youth (NEWS-Y) (Fermino et al. 2013), with one of the studies adapting this method to the Brazilian reality (Lima et al. 2013). It should be noted that these evaluation methods of the perception of the environment and health are recommended by the World Health Organization (WHO).

Silva et al. (2010) researched adult subjects based on the WHOQOL-BREF (Habitual Physical Activities Questionnaire) adapted to Brazil. Alencar et al. (2010) applied this method to elderly people (WHOQOL-OLD). They observed that there is a relationship between the practice of physical activity and quality of life. In 2012, it was noted that there was also a need for a campaign to motivate people to attend these open public spaces, as well, the improvement for the infrastructure to make these spaces more attractive (Fermino et al. 2012).

Lima (2013) made a cross-cultural adaptation of the Brazilian version of the Neighborhood Environment Walkability Scale for Youth (NEWS-Y) questionnaire to assess the relationship between adolescent physical activity and distance from the leisure area. They observed that leisure areas need to be up to 10-min walking distance from the user's residence for them to be motivated to practice physical activity.

These studies show that the quality of the public spaces can be observed through the relationship between the characteristics of urban land use, local traffic, the presence of adequate infrastructure for sports practice, user safety, adequate lighting,

park aesthetics, climatic conditions provided by the presence of vegetation or bodies of water, among others (Hino et al. 2017).

8.4 United Kingdom

The United Kingdom (UK), the USA and Australia were pioneers in acknowledging the role of the natural environment, including green areas, to improve the health of the population (Shanahan et al. 2015).

The research development in the field contributed to this and, at the same time, benefited itself from the existence of social and environmental consolidated databases that enable approaches with health at different scales. The British Household Panel Survey (BHPS) stands out at a national level, allowing multidisciplinary approaches at the individual and household level, seeking to understand the economic and social changes in the UK. The presence of much more regional databases has also contributed to improving research in the area, such as the annual resident's survey Bristol Quality of Life (QoL), which captures the perceptions, opinions and lifestyle of the city's residents (Bristol City Council 2017). These databases also stand out for being continuous, the BHPS began in 1991, and the QoL is in its sixteenth year.

Another relevant aspect of research production in the UK is the diversity of approaches and scopes. This diversity can be seen in the multiplicity of studied outcomes, i.e. mental health, physical activity, obesity and others; different scales—from the national scale to more local studies; and the diversification of the used methods.

One of the most frequent themes in these studies is the relation between mental health and green areas. In this group, national studies were undertaken to understand different associations, such as between urban green spaces and well-being, and urban green spaces and mental distress (White et al. 2013); urban green areas and mental health according to gender across the course of life (Astell-Burt et al. 2014); the impacts of green areas on mental health associated with moving to greener/less green urban areas (Alcock et al. 2014). All of these studies used data from the British Household Panel Survey (BHPS) and presented positive associations between green areas and the outcomes studied in mental health.

The Bixby et al. (2015) study casts doubt over whether positive results found in surveys done at the neighbourhood level could be extrapolated to the city level. After assessing the associations between green space coverage with the risk of death from all causes, i.e. cardiovascular disease, lung cancer and suicide, in the 50 largest cities in England, this research did not find significant differences for these risks between the greenest and least green cities. New studies need to understand the gap between these two scales.

Another significant aspect of these studies addresses deprived urban populations. In Scotland, researchers found that the amount of green space in the neighbourhood and the type of access to these areas were significant predictors of stress, and the frequency of visitation to the green areas in winter and views of green space from the home were predictors of general health in four highly deprived communities

(Ward Thompson et al. 2016). Roe et al. (2016) conducted a study in ethnically diverse cities in the UK indicating that the perception and use of green areas vary among ethnic groups and are also relevant as predictors of health only for the poorest health group. Another study conducted by the same researcher, evaluating stress regulation in two deprived urban areas in Scotland, pointed out that the relations between the characteristics of a neighbourhood, including local green space, and the stress reduction, vary by age, gender and other demographic variables (Roe et al. 2017).

Another investigated outcome was the association between green areas and obesity and/or physical activity. A study based on data from the Bristol Quality of Life survey with the participation of 6821 adults indicated that those who live nearer to parks were more likely to carry out the recommended physical activity and had a lower risk of being overweight or obese (Coombes et al. 2010). However, researchers found that physical activity can be the main explanatory mechanism when they evaluated associations between the green areas availability and physical activity (Ord et al. 2013).

Most studies focus on the neighbourhood and city scale, but one of them focused on a smaller scale. This same study also took a different approach by working with a qualitative experiment that sought to understand the place of health and well-being for park users. The researchers did an iterative content analysis of 312 questionnaires delivered face-to-face in situ. The result was the creation of a taxonomy that illustrates the reasons for the use of parks as well as their effects on users (Irvine et al. 2013).

Finally, it is important to note that the UK has also benefited from studies conducted in a multicentric way. We found three studies in this category, all of them using data from the Positive Health Effects of the Natural Outdoor Environment in Typical Populations in Different Regions in Europe (PHENOTYPE), which collected data in Barcelona, Spain; Doetinchem, the Netherlands; and Stoke-on-Trent, UK. A positive association has been identified between natural outdoor environments (NOE) and cognitive function (Zijlema et al. 2017), but a relation between mental health and residential NOE exposure was not found (Triguero-Mas et al. 2017). Another study, also developed with data from PHENOTYPE, addressed the relation between the neighbourhood's environment, the social environment, and mental health (Ruijsbroek et al. 2017).

8.5 Conclusions

This chapter sought to develop a review about the relations between green areas and health on different scales in Brazil, China and the UK. There has been an increase in the number of studies in this field in all studied countries and the findings support a positive relationship between green areas and health, mostly physical health. However, these studies did not focus on their explanatory mechanisms.

Sometimes, urban sprawl can reduce some urban green areas, especially in vulnerable areas. It has observed that deprived urban populations cannot enjoy these areas,

especially in China and the UK. In the UK, there are efforts underway to improve the quality of life provided by urban green areas on different levels, national, regional and municipal. In China, green areas are not meeting population demand. Thus, a programme has been created to increase urban green areas to increase the quality of life of the population. In Brazil, the decision to build an urban park depends on the resources availability of the municipality, after socio-economic–environmental analyses, which will support its maintenance. Given the health outcomes related to green areas, investments in green areas in Brazil and China are important, since they can reduce inequalities.

Research about urban green areas and health is very important to evaluate the quality of these urban open areas. New studies could explore a longitudinal approach and seek a standardization of the concept of green areas to facilitate a more consistent correlation of the findings. These data are very important for physicians, urban managers, urban planners and architects who seek to re-qualify urban areas and re-establish urban health.

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