Green areas and public health: improving wellbeing and physical activity in the urban context

Spazi verdi e salute pubblica: migliorare il benessere e l'attività fisica nei contesti urbani

Daniela D'Alessandro,[1] Maddalena Buffoli,[2] Lorenzo Capasso,[3] Gaetano Maria Fara,[4] Andrea Rebecchi,[2] Stefano Capolongo,[2,5] and the Hygiene on Built Environment Working Group on Healthy Buildings of the Italian Society of Hygiene, Preventive Medicine and Public Health (SItI)

[1]Dip. Ingegneria civile, edile e ambientale, Sapienza Università di Roma, Italy; [2]Dip. Architettura, ingegneria delle costruzioni e ambiente costruito, Politecnico di Milano, Italy; [3]Dip. Sanità pubblica, medicina sperimentale e forense, Università di Pavia, Italy; [4]Dip. Sanità pubblica e malattie infettive, Sapienza Università di Roma, Italy; [5]coordinator of the Hygiene on Built Environment WG

Corresponding author: Stefano Capolongo; e-mail: stefano.capolongo@polimi.it

INTRODUCTION

About 3.4 billion people (half of the world's population) live in urban areas today: it has been estimated that the proportion will rise to 60% by 2030, and the absolute number will be 6.3 billion by 2050.[1] The understanding of how urban environment affects health outcomes and how it could produce health benefits is therefore an urgent priority, as recognized by WHO in the declaration of 2010 as the Year of Urban Health.

Unfortunately, due to increasing urbanization, combined with the spatial planning policies of densification, nowadays homes have become more and more separated from green environments, although, as argued by van de Berg et al.,[2] a restricted access to green spaces may increase vulnerability to the impact of stressful life events on mental and physical health.

At present, several studies provide evidence, albeit still rather weak, of some association between green spaces, wellbeing, and health.[3-6] In the most recent years, this topic has gained an increasing interest.

RESULTS

A «web of knowledge» search with just two terms, «green space and health», yielded 2 hits for 1990-1999, 34 for 2000-2009, and 45 from 2010 to June 2013.[7] The reasons for this rise in interest are many. Some papers reflect concerns that urbanization, environment degradation, and lifestyle changes are quali-quantitatively diminishing occasions for human contact with nature; others consider nature as just one aspect of the physical environment that may be potentially beneficial for health. In general, research aimed to propose practical measures that could directly or indirectly provide access to nature, including interventions about housing, transportation, and recreation.

In the same paper,[7] the Authors performed a «review of reviews» on the topic until April 2013, involving 56 relevant reviews. Of the peer-reviewed articles, the majority appeared in journals focused on public health or environmental planning.

The reviews varied considerably in methodology, guiding aims, and environmental aspects discussed.

Despite this variety in methods, aims, and focus, there was a strong agreement about the methodological state of the art. The reviews agreed about the following conclusions:

- most of the studies are observational;
- few primary studies have investigated in a consistent and rigorous way the relationships between contact with nature and health;
- few primary studies have explored how the effects may vary by population subgroup, type of natural environment, or type of contact with nature;
- consistent and objective measurements of both exposure to nature and health-related outcomes remain elusive.D

Reviews showed three common weaknesses:

- search strategies did not always address the variety of environments or settings that count as "natural";
- reviews from individual-based disciplines tended to ignore evidence from others (e.g., psychology *vs.* epidemiology);
- the variety of health outcomes used in primary studies was not well addressed.D

Nevertheless, the reviews generally agreed that beneficial effects from contact with nature do occur. Contact with nature may affect health via multiple pathways, that have received relatively large amounts of research attention: air quality, social co-hesion, stress reduction, and physical activity (**figure 1**). Path-ways mostly proceed from the natural environment to health effects via contact with nature, but two of them also proceed directly from the natural environment to stress and air qual-ity, respectively, implying that the natural environment may affect air quality and health without engaging first with nature as such. The two-headed arrow between "natural environ-ment" and "contact with nature as such" acknowledges that these are connected in a two-way relationship. The two-headed arrows between the boxes describing air quality, phys-ical activity, social contacts, and stress also imply their recip-

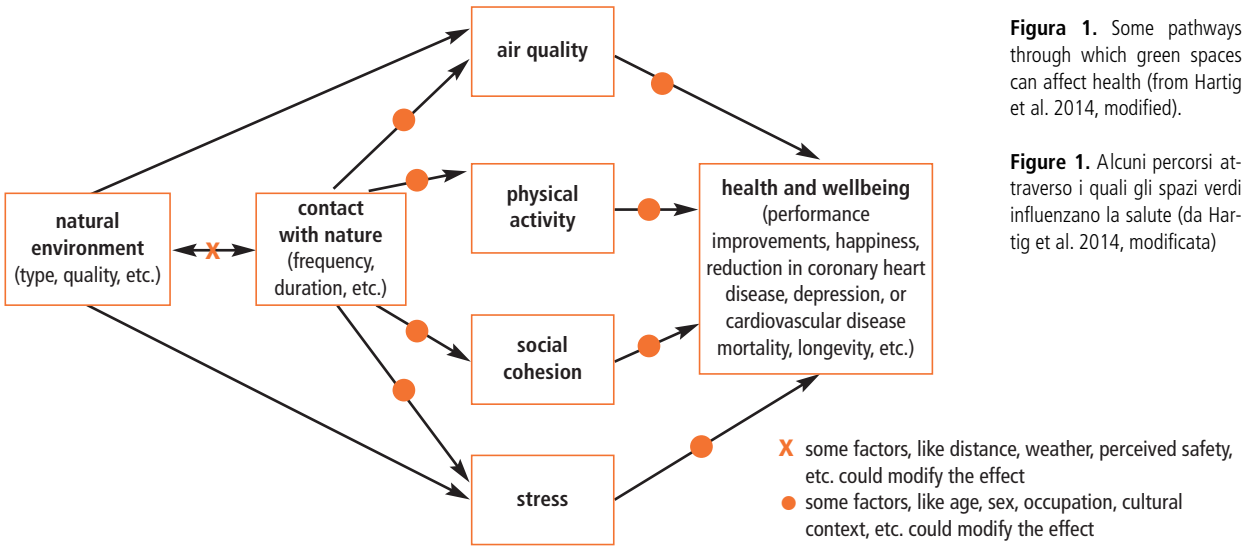

Figura 1. Some pathways through which green spaces can affect health (from Hartig et al. 2014, modified).

Figure 1. Alcuni percorsi attraverso i quali gli spazi verdi influenzano la salute (da Hartig et al. 2014, modificata)

rocal relatedness; however, each may be related with all the others and not only with the ones closeby.

Air pollution

Interactions between green spaces and health may lead to positive and negative effects, involving both social and physical health effects. Impermeable surfaces such as roofs, facades, and roads impair the microclimate by disturbing the radiation and energy balance of areas. *Vice versa*, green areas in one's living environment may ameliorate air pollution, and the urban heat island effect.[8,9] Trees, shrubs, and other kind of vegetation may affect air quality and, through it, human wellbeing and health. Trees and other vegetation may reduce levels of some pollutants, including gases and particulate matter (PM), but they may also contribute to air pollution by releasing hydrocarbons, including isoprene and terpenes, with considerable variation by species.[9,10] Some trees and plants release pollens, aggravating asthma and allergies. In fact urban and sub-urban ecological changes can affect the geographical range of diseases related to pollens, insects, and parasites.[11,12] Finally, trees improve air quality indirectly when they cool urban environments and reduce building energy demand.[7] Hence, the positive benefits of green space cannot be generalized.

Social cohesion

Natural features and open spaces in a residential area can play an important role in residents' feelings of attachment towards the community, and their interactions with other residents. Social cohesion refers to shared norms and values, the existence of positive and friendly relationships, and feelings of being accepted and of enjoying membership. It is more a characteristic of neighbourhoods than of individuals[13] and therefore more likely to be influenced by physical characteristics of the neighborhood, such as the availability and quality of green spaces and natural elements. At the same time, green spaces that are perceived to have become overgrown or to be unmanaged, may have a negative effect on peoples' wellbeing by increasing anxiety caused by fear of crime.[7] Kneeshaw-Price et al.[14] evaluated five neighbourhood crime-related safety measures to determine how they were interrelated. They found that neighbourhood-active children living in the lowest crime-quartile neighborhoods had 40 minutes more of total MVPA (moderate to vigorous physical activity) in comparison to neighborhood-active children living in the highest crime-quartile neighbourhoods .

Generally, the few available studies suggest a positive relationship between social cohesion and natural environments.[7,15] As argued by Hartig et al.,[7] social cohesion within a neighborhood does not lend itself to experimental research, which makes it difficult to determine whether relations with environmental features are causal. Some researchers[16] found a positive association between the presence of trees and grass in common spaces and informal social contact with neighbours. Moreover, the relationship between greenery and social contacts appeared to be mediated by the use of the common spaces. The research also showed that social contact was positively related to one's sense of safety. Subsequent studies showed that residents with more trees and grass around their buildings displayed less aggressive behaviour, and their buildings were associated with fewer crimes.[17,18] More recent research suggests similar positive effects of greening vacant lots, especially a reduction in gun assaults and disorderly conduct.[19]

Stressful life

In general, individuals living in areas that lack green spaces may be more vulnerable to the negative impacts of stressful life events because they have less opportunities for nature-based coping strategies than individuals living in areas with abundant green spaces.[2] Thus, the availability of green space in the surroundings may be an important environmental factor that moderates the relationship between stressful life events and health. According to the WHO, mental health promotion should include actions that create living conditions and environments that support mental health and allow people to adopt and maintain healthy lifestyles.[20] Green spaces are thought to influence mental health through an increase in physical activity, by providing places for neighbourhood residents to meet, encouraging social ties, and alleviating stress and mental fatigue.[21] Van de Berg et al.[2] observed that respondents with a higher amount of green space in a 3 km radius were less affected by experiencing a stressful life and had a better perceived mental health. The moderating effects of green space were found only for those within 3 km, presumably because the 3 km indicator is more affected by the presence of larger areas of green space.

Nevertheless, findings from the studies on green spaces and mental health relationship are not homogeneous. Most studies were cross-sectional, and are thus subject to reverse causality. Gascon et al.,[22] in a recent systematic review, found limited evidence of a causal relationship between surrounding greenness and mental health in adults, whereas the evidence was inadequate in children. However, at least two longitudinal studies in the UK provided evidence that individuals living in greener areas had better mental health outcomes over time,[23,24] while a study in Sweden found an additive protective effect of green space and physical activity on mental health among women.[25] Astell-Burt et al.[26] reported a protective effect of green space on minor psychiatric morbidity across the lifecourse in early adulthood for men. In contrast, the benefit of green space for women emerged later in adulthood.

Despite the advantages of longitudinal designs, concerns about unmeasured confounds remain, most notably the inability to control for non-random selection of residents into neighborhoods. For this reason Cohen-Cline et al.[21] examined the association between access to green space and mental health among adult twin pairs, a way to address this self-selection problem because they provide a method of controlling genetic and environmental confounds. Authors have hypothesized that greater access to green space is associated with less depression, but provide less evidence for effects on stress or anxiety.

Access to green spaces showed psychological health benefits for socioeconomically deprived populations, in at least three stud-

ies;[27-29] green space may therefore narrow health inequalities. A recent large, cross-sectional international study,[30] although not proving causality, concludes that socioeconomic inequalities in mental wellbeing were smaller among urban dwellers reporting good access to recreational/green areas and there was no such difference for the other tested neighborhood services. There are reasons that support the plausibility of a causal effect: for example, green spaces between residences and heavily trafficked roads can reduce occupant noise annoyance, vegetation can conceal displeasing structures, and landscaping around housing can help residents maintain privacy and avoid feelings of crowding.

Hordyk et al.,[31] investigating everyday practices of immigrant children and families in the context of urban green spaces such as parks, fields, backyards, streetscapes, gardens, forests and rivers, observed that activities in natural environment serve as a protective factor in the health and wellbeing of this population, providing emotional and physical nourishment in the face of adversity. Participants accessed urban nature to minimize the effects of inadequate housing, strengthen social cohesion and reduce emotional stress.

Physical activity

A growing body of evidence suggests that a major determinant of physical activity is access to green spaces. In 2004, the *Guide for Community Preventive Services* of the CDC recommended «creation of or enhanced access to places for physical activity based on strong evidence of their effectiveness in increasing physical activity and improving physical fitness».[32,33] As the *Guide* noted, most of the evidence for this recommendation derived from cross-sectional studies. Low rates of physical activity are an important contributing factor to rising levels of obesity, as well as risk of cardiovascular disease, hypertension, type 2 diabetes, stroke, colon cancer, and premature death. Physical activity also promotes mental health across the life span.[34,35] Recent evidence suggests that the health benefits of increased physical activity are largest among those who were initially physically inactive[36] and in youth.[37-39] The outdoor environment may influence how much physically active an individual is by offering suitable spaces for certain types of performances. It may also attract people outdoors because of the experiences it offers. Such outings ordinarily entail some form of physical activity, at least walking. An important precondition for the use of natural environments for physical activity is individuals' (perceived) safety.[7,14] Although there are possible negative effects associated with physical activity (e.g., sports injuries) as well as with being in a natural environment (e.g., Lyme disease from tick bites), most of these effects are not specific to physical activity in a natural environment.

The built environment is an important factor of influence, as it can facilitate or inhibit participation in physical activity. The literature has examined how different aspects of public open space, such as access to, size, and design features, are associated with participation in physical activity. Proximity to parks and recreational settings are generally associated with greater physical activity.[40] Qualitative evidence further shows that safety, aesthetics, amenities, maintenance, and proximity of public open spaces are important attributes for supporting physical activity.[40]

Despite the increasing number of studies in this field, there are some inconsistencies that confuse urban designers and policy makers and prevent the development of evidence-based guidelines. Koohsari et al.[40] in a recent review identified conceptual and methodological gaps that need to be addressed to progress research on public open space and physical activity, which include:

- **uneven definition of open space**, which introduces diffi-culties in comparing and collating evidence across different studies. While there is a lack of research into the influence different types of public open space have on physical activity, there is some evidence that non-park public open spaces might be important for physical activity (e.g., walking trails). As such, there might be specific requirements for designing a walking trail to accommodate a wide range of physical ac-tivities within a small linear place compared with a park.
- **use of longitudinal and experimental study design when possible**: in particular research on public open spaces and physical activity would benefit from experimental studies that measure behaviours before and after the introduction of new public open space or renovation of existing public open space. This point could take advantage from the increase in urban regeneration interventions that several coun-tries, including Italy, are promoting. A recent study of people who relocated from one neighbourhood to another, found that gaining access to three different types of public open space (parks, sport fields, beach) increased daily walk-ing by 18-20 minutes for each type of public open space gained.[41]
- **exploring public open space exposure in multiple contexts**: previous studies have primarily focused on public open space in a residential context, while the effect of public open space in other settings (e.g., around workplaces and schools) has been ignored. Karusisi et al.[42] found that the number of supermarkets around workplaces was associated with walk-ing for transport among workers. Dalton et al.[43] observed that active travel to work was negatively associated with the availability of free car parking at workplaces.
- **moving specific measures of physical activity into public open space**: public open space can influence activity in at least three ways:
  a. it can be a setting where people engage in physical activity;
  b. it can be a destination to which people actively travel either to be active or simply to socialize;
  c. it can be used as part of a route to pass through to reach another destination. Hence public open space can contribute to different types of physical activity behaviours. Few studies have attempted to understand the variety of ways public open spaces influence physical activity.D

Koohsari et al.[40] also considered the importance of the quality of public open space, in terms of features and characteristics related to physical activity or walking, but also on the char-

acteristics of surrounding built environment and on the association between public open space type and user profiles (age group, socio-demographic group, sex). Furthermore they stress the need to identify threshold values needed to attract people to public open space.

CONCLUSIONS

Providing adequate public green spaces means offering people both physical and psychological health benefits. As argued by Wolch et al.,[9] most studies reveal that the distribution of such space often disproportionately benefits the most affluent communities. Giving everybody access to green spaces is therefore increasingly recognized as an issue of environmental justice. Many cities in other countries (e.g., both the US and China) have implemented strategies to increase the supply of urban green space, especially in deprived neighborhoods. Strategies include greening of marginal urban land and reuse of obsolete or underutilized infrastructures.

The definition of appropriate and innovative solutions could benefit from collaboration between different professions.[45] Therefore it is necessary to encourage the integration of information between various professional figures, such as urban nature conservationists, urban planners, environmental psychologists, and public health specialists.[45,46] Hartig et al.[7] underline that a lot more remains to be done to help environmental policy makers and designers to establish realistic assessments of what nature can and cannot do in their domain of activity. Part of this task involves explaining how health benefits might overlap (or conflict) with other benefits, such as better storm water management, species preservation, and carbon sequestration. At the same time, a comprehensive methodology for analysis of the associations between aspects of the urban environment and residents' health needs to be identified and implemented. As argued by Rydin et al.,[1] the absence of such a methodology is largely attributable to the complex nature of urban systems, in which many factors affect social and health outcomes, compounded by the scarcity of consistent data available at the urban scale. In this field, Koohsari et al.[40] suggest several indications to improve research approaches. Building a body of evidence in this way could contribute to provide much-needed data to urban designers to plan a public open space system able to promote public health.

Conflicts of interest: none declared

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