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## **Green infrastructure, physical activity and health. Evidence of their relationships in Spain**

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### **Introduction**

Currently, more than fifty percent of world population lives in cities; in the most developed regions upwards of 75% are urban residents (in Spain 77%), (UNFPA, 2011). We are in a moment where the *urban species* has already appeared for the first time. These cities do not often offer a healthy living environment. This fact and the lifestyle habits characterized by sedentary lifestyle, obesity and a poor diet cause health problems, increasing the incidence of non-communicable diseases, as the World Health Organization has revealed. For this reason, the design and planning of cities should be aimed at seeking solutions to these problems and green infrastructure provides an opportunity in this regard (Lafortezza, Davies, Sanesi & Konijnendijk, 2013).

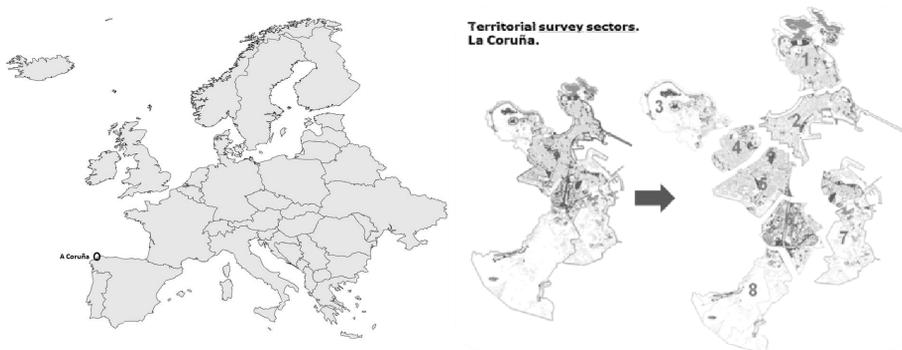
### **Literature Review**

Ecoplanning must include strategies for reducing health problems. The use of green infrastructure (GI), a “green vitamin”, can contribute to a planning based on an environmental logic and being part of preventive health systems, emphasizing programs that enhance physical activity, line of work underlined by EU (2013).

GI may be a key element to improve health, both physical and mental level, because of the fact that it is based on a body of evidence that shows that green spaces can improve quality of life, welfare, psychological health and to increase life expectancy (Tzoulas et al., 2007). There are several variables that influence the use and kind of activity developed in green spaces and how they can contribute to the improvement of physical activity and health, accessibility and number of green spaces emphasize among them, basic to enhance the use and frequency. Although the size is important for health (Mitchell, Astell-Burt & Richardson, 2011), small spaces also provide benefits related to health and environment, including pocket parks (Peschardt, 2014) and residential gardens. Though there are a lot of studies that analyze this relationship, mainly in northern European countries and EEUU, few research studies have been carried out in Spain and the extrapolation of the information may not be accurate due to the variation of urban typologies. Schipperijn, Bentsen, Troelsen, Toftager and Stigsdotter (2013) indicated that physical activity

practiced in an urban green space could be motivated by specific characteristics of the study area. These statements are also supported by Sander and Zhao (2015) who consider that green and blue infrastructures are fundamental to the influence on human health and that sustainable cities require the knowledge of how population value those services and how those values vary within cities and which are the factors that affect them.

In Spain, this approach should be integrated in the planning process and studies that incorporate our cultural, social and environmental bias should be carried out.



**Figure 1. Location of A Coruña (Northwest of Spain). (2) Physiognomy and territorial division by sectors**

## Goals and objectives

This research project intends to find evidence about the connection among GI, particularly urban green spaces, physical activity and health, analysis that has already been dealt with others researchers (Ward Thomson, 2011; Schipperijn et al., 2013), but never in cities of Spain. The goal is to achieve strong arguments to offer an urbanism more conciliatory with nature and that is inclusive with reality of each territorial context and thus to optimize the design and to enhance physical exercise, improving physical and mental health and the welfare.

The aim is to analyze the preferences of the population about different scenarios, design criteria and to identify patterns of use according to sociocultural and spatial variables, determining factors and barriers that limit the use. Furthermore, another aim is to analyze population health and the physical activity categories in relation to the use, frequency and proximity, among others, of the green spaces. It is developed, based on its territorial differences and adapted to social variables, for the improvement of health

which will be analyzed by means of population surveys and visual preferences. In the same way, a detailed study of the system of green spaces and the history of urban evolution from a green infrastructure point of view is developed.

## Methods

It is set out a methodological framework that tackles territorial and population studies where social, health and physical activity variables besides those relating to the use of green spaces are included. A research was carried out in La Coruña (Fig. 1), the most urban and dense city in Galicia (Spain) and with social and territorial particularities and very little encouraging data of diseases and obesity. It is proposed a qualitative method based on territorial differences and developed by means of a division into sections using physical and social aspects (Fig. 2). The first part of the research project presents spatial identification and characterization of the green areas, including its accessibility, the compliance with the European recommendation regarding distance from residences and analyzing sizes, peculiarities and weakness in territorial distribution. The second part is the population study; 460 interview surveys were carried out according to sex and age quota, divided into territorial groups selected for its urban typology (Fig. 1) and social character. The most often used questions in health European survey have been used to analyze the health state and besides, IPAQ questionnaire (IPAQ, 2005) has been put into practice to look into physical activity. In the same way, an *ad hoc* survey that includes variables of frequency, type of use, accessibility, length of visit, the most important inconveniences that limit the use, as well as social variables of age, sex, education, etc. has been developed. Finally, visual surveys about preferences of scenario of green spaces for their zone of residence have been carried out.

## Results

As more significant results, we can affirm that the methodological framework proposed is appropriate and its modular structure allows the partial analysis of the relationships to examine. A Coruña has natural, heritage and singular hubs that can be essential for the design of a multifunctional green infrastructure. The green spaces of A Coruña are mainly of small size distributed all over the city, those with the largest size are located in its peri-urban areas.

Most of the population (77.7%) chooses green spaces as their favourite public space compared to other greyer spaces, and there are territorial differences about the most visited green space marked by the size and accessibility. Most of the population takes less than 15 minutes to arrive from their residence at

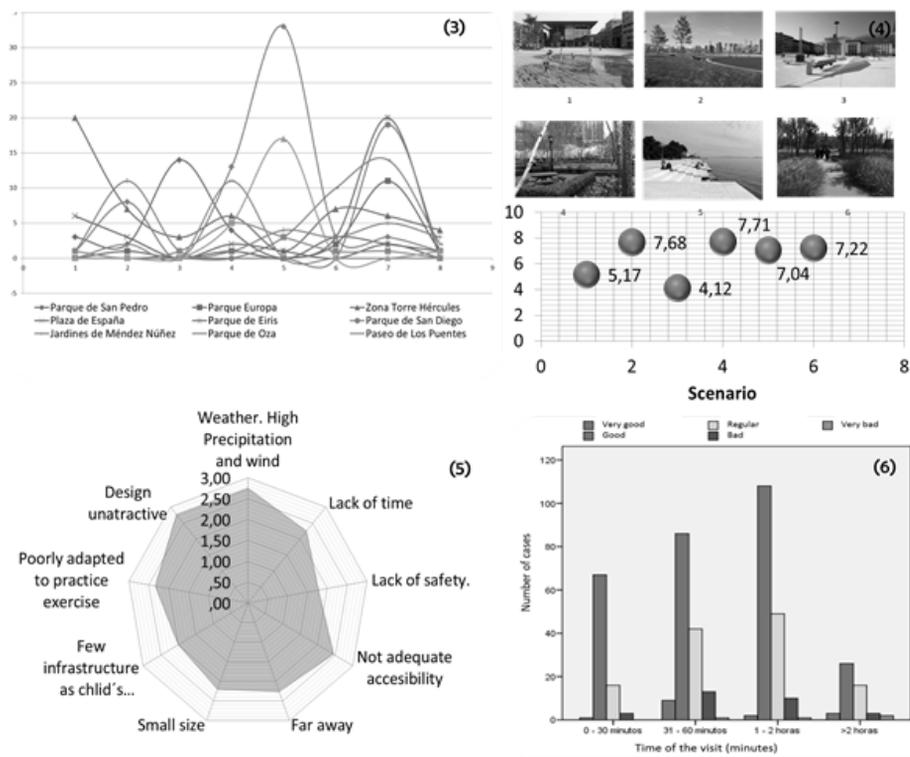
their most visited green space. In fact, 74.9% of population choose space that are less than 1000 meters from their home and 48.3% less than 500 meters.

It is revealed that the distance to green spaces from the residence is one of the greatest limiting factors of use. The Figures 3-6 show part of the principal results. Population demands attractive, large, nearby (>500-1000m) and lush green spaces, adapted to practice physical activity. All these preferences should be integrated into the different processes of urban planning.

As regards the scenario that they would select for their neighborhood, differences among territorial sectors are detected which is an important information for adapting the design to the reality of users of each zone. The most significant problems for the use of green spaces are an unattractive design, bad weather, limited accessibility, and lack of adaptation to practice physical activity. The lack of security is not perceived as a problem with regard to use green spaces, which is different from other research (Cabe Space, 2010). Most of the population (51%) prefers proximity to size or a more attractive design.

Sixty six per cent (66%) of the population declares that their self-perceived health status is positive, while only 6% answers that it was bad; the results are better than in other European cities. Moreover, it is confirmed that health status is related to level of education, the greater the level of education, the greater the percentage of positive answers. 60% of the population indicates that they do not suffer long-term diseases; this is above European and Spanish average. The greatest percentage of persons with negative self-perceived health status, presence of diseases or medicine consumption is reached in the most densely populated zones and with less green spaces.

A high level of physical activity is achieved by 57% of people surveyed while a moderated level is achieved by 42% of the survey group, according to IPAQ (2005), this means that population is active although people that live in zones more densely populated also reach lower average physical activity. The high category of physical activity corresponds with positive, good (64%) or very good health status. As the level of physical activity decreases, the percentage of people with negative health status and a higher incidence of diseases increases. Furthermore, it is shown that the more days a week people practice physical activity, the lower medicine consumption. The most common use of green spaces is to practice physical exercise and relaxation. The percentage of population with a positive health status decreases as visit frequency decreases.



**Figure 3. Relationship between the most visited green areas and the sector of residence. 4. Visual preference survey of six recent landscape architecture scenarios. 5. The most important drawbacks that limit the use of green areas. 6. Relationship between time spent in green areas and self-perceived health.**

The analysis of bivariate correlations between the size of the most visited zone and the self-perceived health, the physical activity level, the length of the visit and the distance from the residence shows the existence of significant correlations, although weak. The highest values are obtained in the relationship among travel time, distance and surface, although with a low value: 0.266. The connection among these variables is enhanced and they should be integrated into the planning.

## Discussion

In general, population demands nearby green spaces (less than 500m), with vegetation, attractive design and adapted for physical activity. Proximity is important for the welfare of persons and this characteristic has been shown in other studies as developed by Van Herzele & de Vries (2012). However, there

are also studies reporting that the nearest green areas are not visited (Schipperijn, Stigsdotter, Randrup & Troelsen, 2010).

On the whole, self-perceived health status is positive (good and very good health status) although there are territorial differences according to the zone of residence and by age groups.

Residents that chose the scenario of the most natural public space, the ecological design, prefer the variable proximity. This information is important because it can be used to improve the processes of green system in general and like an economical solution tool. Ward Thompson & Aspinall (2011) suggest that natural open spaces offer opportunities for peace, relaxation and social activities. Territorial sectors with less green spaces and more densely populated concentrate the highest values of presence of diseases, negative self-perceived health and medicine consumption, results that coincide with other analysis such as that carried out by Van Dillen et al. (2012).

The category of physical activity of A Coruña population is different according to the zone of residence and by age groups. In general, the most active people feel healthier, have less diseases and consume less medicines, although the connection among frequency and length of the visit to green spaces and the physical activity level have not been found. The population that visits for more time and more frequently green spaces feels subjectively healthier although the relationship with physical activity categories has not been showed. In fact, there are studies that show that residents of the greenest areas, with better accessibility, did not practice more physical activity (Groenewegen et al. 2012)

The results show that health improves with the use of green spaces and the practice of physical activity, although direct relationship between this last one and the use of green spaces is not clear. Since the health improves with the use of green spaces and the practice of physical activities, if we promote physical activities developed in green spaces, we may strengthen health benefits from that double perspective. Previous studies showed that this may be a synergic benefit owing to be physically active in green areas (Maas & Verehij, 2007).

If we strengthen green exercise, we solve the population demand to practice physical activities in a natural environment inside the cities, where the nexus among physical activity, health and green infrastructure can be consolidated.

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## Conclusion

If green spaces are designed to practice physical activity and its use and access are facilitated, general health could be improved and an important economic saving in preventive medicine could be obtained. This strategic opportunity of territorial planning is complemented by the positive assessment of Galician population of the practice of physical activities and the generalized awareness about its benefits on health. Moreover, one of the objectives of visiting green spaces is the physical activity that, in the end, will result in better health. Thus, the use of green spaces for physical activity can improve health.

The ecological territorial planning, based on green infrastructure theories and designed to enhance its attractive and the physical activity, and including territorial and social particularities of city, is a suitable solution for the cities of the 21st century.

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