Abdelfattah, L.; Boni, G.; Carnevalini, G.;
Choubassi, R., Gorrini, A.; Messa, F.; Presicce, D.

A user-centric approach to the 15-minute city:
examining children's walkability in Bologna

Case Study Report

A user-centric approach to the 15-minute city
Examining children's walkability in Bologna

Lamia ABDELFATTAH, Systematica Srl, Italy

Giulia BONI, Systematica Srl, Italy

Giulia CARNEVALINI, Systematica Srl, Italy

Rawad CHOUBASSI, Systematica Srl, Italy

Andrea GORRINI, Systematica Srl, Italy

Federico MESSA, Systematica Srl, Italy

Dante PRESICCE, Systematica Srl, Italy

Abstract

According to the World Health Organization (2020), 80% of adolescent children in cities worldwide have insufficient physical activity levels. Studies from the UK and Europe show that children's walking trips have dropped by a significant margin in recent decades. Active Commuting to and from School (ACS), which is one of the main ways for children to meet their recommended daily physical activity levels, is also in decline (Shaw et al., 2013). These trends correspond to various interrelated socio-economic and environmental factors that involve cultural expectations as well as preparedness of the urban environment to meet children's needs.

One of the most direct and axiomatic factors affecting children's urban walkability is their proximity to daily services and their ability to reach important destinations on foot. This study employs two theoretical concepts as a basis for service proximity across the urban territory: the usefulness of the urban realm as defined in Jeff Speck's (2013) General Theory of Walkability and the chrono-centric '15-minute city' concept as proposed by Carlos Moreno et al. (2021). These two concepts are seen as complementary and support cross-validation of the mapping results of the study carried out at city scale.

Produced as a result of research in partnership between Systematica Srl, the Bologna Municipality and Fondazione Innovazione Urbana and presented at the 6th edition of the Biennale Spazio Pubblico 2021, this study adopts a user-targeted approach to the 15-minute city that focuses on the mobility of middle-school age children (11-14 years) in the city of Bologna, Italy. The goal of the study is to analyze the distribution of the city's supply of daily services relevant to children of this age group and the corresponding potential to reach these services on foot. The methodological approach combines advanced analytical modelling using GIS tools with data supported by the Bologna Municipality database system and open-data sources to analyze the proximity of 8 essential service categories, sub-categorized and weighted according to their significance to the target users.

The mapping analysis revealed that Bologna performs fairly well in terms of overall proximity of services with most districts covered by at least half of the 8 service categories within a 15-minute walking timeframe. The walkability analysis using Walk Score showed that 77% of the population of Bologna live in areas characterized by a high walkability index. Services targeting the 11-14 age group are also well distributed across the urban area. Only three neighborhoods were identified as potential areas of intervention. Preliminary analysis of the mapped data also indicates that 90% of schools - a key destination for this age group - are already located in highly walkable areas.

Abdelfattah, L.; Boni, G.; Carnevalini, G.; Choubassi, R., Gorrini, A.; Messa, F.; Presicce, D.

A user-centric approach to the 15-minute city: examining children's walkability in Bologna

Ensuring walkable distances to primary needs is the first step to enhancing adolescent children's physical activity levels and supporting their right to independent mobility within the city. From a methodological perspective, this practical application aims to shed light on the importance of adopting a user-centric approach when evaluating accessibility in cities using a methodology that can be applied to other social groups and urban contexts.

Keywords

Walkability, User-centric approach, Child-friendly cities, 15-minute city, Independent mobility, GIS mapping

1. Introduction

1.1. Towards children's independent mobility

How children engage with the public physical environment around their homes is one of the key determinants of their health, behaviour and development. In principle, the built environment is seen as a medium where children first develop their ability to navigate and experience the city. This is especially true for near-home environments. Environmental psychology research also shows that social and physical security in local environments are vital to children's perceptions of risk and safety (Korpela, 2002). Great focus is placed on local environments close to the home as the primary children infrastructure. To that end, a children's infrastructure network at the neighbourhood level that allows for safe and enjoyable journeys is crucial in supporting their developmental health.

Among its many diverse benefits, walkability is a critical component in securing autonomy in daily urban life, particularly for children and young adolescents for whom walking and cycling are the primary means for exploring their environments independently of their guardians. Despite a recognized intrinsic value of a sense of autonomy in their everyday movements, studies show that independent mobility for children has declined significantly in recent decades, particularly in large cities (Shaw et al., 2015). In the UK, for example a study on children's ACS (Active Commuting to School) trends from 1971 to 1990 found that the number of children walking to school without adult supervision dropped from 80% to 9% (Hillman et al., 1990). Studies in the Italian context showed that less than a sixth of schoolchildren in large cities of ages 7–11 go to school unaccompanied by an adult (Prezza et al., 2010).

Aside from promoting independent mobility, active mobility is also a crucial component in boosting children's physical activity levels. According to the World Health Organization, more than 80% of the world's adolescent population is insufficiently physically active as a result of urbanisation. Globally, 4 in 5 adolescents fall short of the WHO-recommended 60 minutes of daily physical activity, which (as described by the WHO) includes "activity for transportation, such as cycling and walking" (World Health Organization, 2020. In high-income countries, insufficient activity in adolescents has increased by 5% (from 31.6% to 36.8%) between 2001 and 2016, due in part to sedentary entertainment activities (ibid.).

Furthermore, observing these figures in the context of road safety statistics, whereby road injury is reported to be the number one cause of death amongst children and early adolescents globally, many of whom are "vulnerable road users" (i.e. pedestrians and soft mobility users), the need to create walkable cities in line with child-friendly design principles becomes clear. Providing the safe, manageable and engaging environments needed to support daily active mobility in children is the first step to support their right to exercise independent mobility.

1.2. Dissecting walkability for children: towards a user-based conception

Whereas traditional approaches in urban planning related to the topic of walkability tend to focus on spatial dimensions, research has shown that individual characteristics of pedestrians have a significant impact on the perceived level of walkability, with particular reference to their gender and age. Pollard and Wagnild (2017), for instance, highlighted that female pedestrians experience the city differently than men, since they are more concerned with security issues related to aggression and harassment. Regarding age, elderly pedestrians were found to be strongly conditioned by the progressive decline in the operation of perceptive sensors and motor-cognitive skills (Gorrini et al., 2018). Children are conditioned, instead, by the lack of coordination in attentive and motor-cognitive processes linked to the evaluation of risk while crossing at intersections (Rosenbloom et al, 2008; Rothman et al., 2014).

Advanced urban planning activities are shifting towards a focus on walkability for children, as one the most vulnerable road users (World Health Organization, 2020). Several urban planning institutions such as NACTO (the National Association of City Transportation Officials) for example, have provided extended guidelines for the design of accessible, safe and inclusive streets for children (2020). However, there is still a lack of knowledge about children's perceived levels of walkability in terms of accessibility to public service and amenities (namely the *usefulness* of the urban environment, following Jeff Speck's General Theory of Walkability, see Section 2.1). In this context, the current paper provides a framework for the empirical assessment of the level of accessibility for children as applied to the case of the Italian city of Bologna.

Figure 1. Children walking alongside their parents in the city centre of Bologna. Source: Corriere di Bologna.

In partnership with the Bologna Municipality and Fondazione Innovazione Urbana (FIU), an advanced mapping analysis was carried out to measure the city's capacity to offer walkable environments with easily reachable destinations relevant to the 11-14-year-old population. According to global studies, children under the age of 11 face much higher parental restrictions limiting their independent mobility: in a study of over 18,000 children aged 7-15 in 16 countries, children of ages eleven and over were found to have far

Abdelfattah, L.; Boni, G.; Carnevalini, G.;
Choubassi, R., Gorrini, A.; Messa, F.; Presicce, D.

A user-centric approach to the 15-minute city:
examining children's walkability in Bologna

more freedom to travel autonomously, including the possibility to walk to school without parental supervision (Shaw et al., 2015). This makes the 11-14 years age group a suitable target group for the purposes of this study.

The research work aims to study the walkability in terms of *accessibility* of near-home environments for children. Near-home environments are defined here as '15-minute' neighbourhoods following Moreno's 15-minute City concept (2021) and in line with children's walkability literature that recognizes 900m (roughly 15 minutes) as the maximum distance a child can be expected to walk to any given destination (ARUP, 2017). These concepts form the basis of the research methodology to follow.

2. Main approach and methodology

2.1. Guiding principles

The research approach follows Jeff Speck's General Theory of Walkability (2013) as a guideline for defining the relevant factors to be included in the study of the 15-Minute City concept, with a focus on the needs of children while walking. In line with the work of Gorrini and Bertini (2018), the current paper relies on a thematic literature review of some of the most relevant scientific contributions about walkability. This review led to the definition of a series of assessment criteria and methods for the evaluation of the level of pedestrian friendliness of urban areas, as follows:

- **Usefulness:** the urban territory should be designed and planned with an adequate level of land-use mix, street connectivity and commercial density, to guarantee the presence of numerous and diverse public services and facilities within a walkable distance of 15 minutes;
- **Comfort**: streets should be designed according to a series of standard criteria of quality and accessibility which accommodate the needs of all pedestrians, but also according to a set of highly recommended elements which support the comfort while walking;
- **Safety and Security**: streets and intersections should be designed to guarantee the safety and security of people while walking and crossing, with particular reference to vulnerable road users such as the elderly and children;
- **Attractiveness**: the city should be designed to have a polycentric structure with several and distinctive areas of attraction for the city users, as characterized by both the quality of the architectural streetscape and the vitality of the social context.

As previously mentioned, the analysis presented in this paper focuses on the first criterium: the usefulness of the urban territory, i.e. focusing on the utilitarian aspect of walkability. This factor is explored through advanced analytical modelling using GIS tools to offer a comprehensive reading of the city. Geographic Information Systems (GIS) can be applied at macro and meso scale to analyse location-based datasets, focused on several topographical-infrastructural elements, the density distribution of public services and amenities and the socio-demographic characteristics of the inhabitants.

Data used in the GIS analysis was retrieved from the Bologna Municipality database system as well as open-data sources to study a broad range of proximity services and the potential to reach these services on foot across different neighbourhoods in the city. The analysis is divided in two levels: (i) mapping of essential services for children, starting from a full list of services as provided by the reviewed datasets, to understand which areas are better served in terms of the static proximity of daily services, and (ii) a walkability analysis using the patented Walk Score® tool that offers a dynamic reading of walkability that includes the factor of time. The Walk Score analysis is mapped both for the general population and for the target user group for comparison.

2.2. Methodology of the study

The service proximity analysis (i) is a pure comprescence analysis based on distance buffers, showing areas where residents can reach each of the selected children-targeted services within a 15-minute walk versus where these services are present but exceed the time threshold and where they are entirely lacking. The list of proximity services identified is organized into 8 categories grouped under 4 macro-categories that stem from a rights-based approach consistent with the UN Universal Declaration of Child Rights (UN General Assembly, 1989); these are Learning, (Access to) Supplies, Physical fitness and Socializing opportunities. These services were further classified according to their prevalence in children's daily lives, giving higher weight to daily services such as schools, parks and sports facilities.

The Walk Score mapping is a more holistic and comprehensive metric as it measures the actual accessibility levels through isochronal analysis. It is based on the analysis of accessibility to each service category in 15 minutes calculated considering travel time, network characteristics - including slope - and population data. Factors considered include the proximity of services, population density and road network characteristics, such as block length and intersections density. The final Walk Score values were calculated by summing up the results of the 8 individual maps for each service category on a grid of 150m. This process was carried out twice: once for the total population and once for the target group (11-14-year-olds). The difference between these two analyses lies in the selection of services with the services for the latter group being the targeted selection as shown in Figure 2. Walking metric assumptions remain unchanged for the two groups considering that walking speed for the target age group is fairly consistent with the general population average.
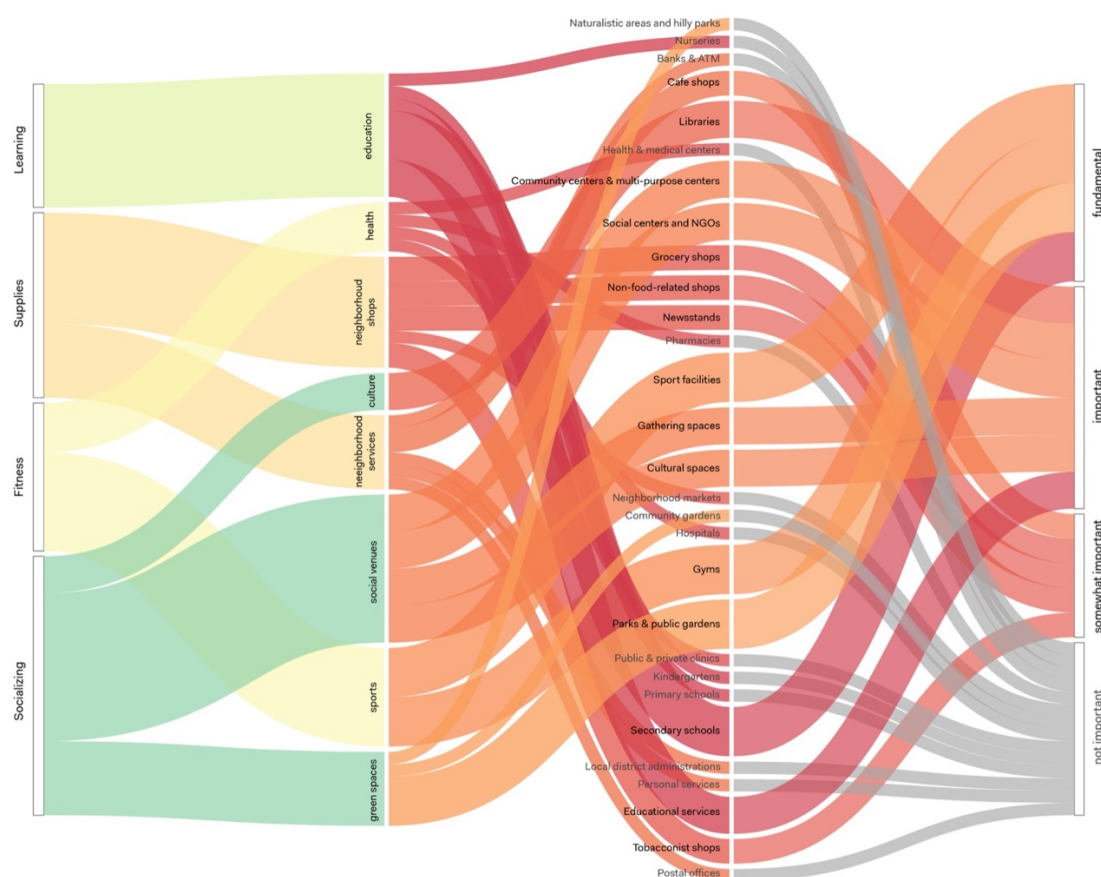

Figure 2 Defining proximity services for 11-14-year-olds. Source: Systematica.

3. Results

3.1. Service distribution across the city

The results of the mapping analysis revealed that Bologna performs very well overall in terms of proximity of services with most districts covered by at least 4 of the 8 main service categories within a 15-minute walking timeframe. The cumulative map (Figure 3) demonstrates that most neighbourhoods are covered by essential services for the 11-14 age group, although some southern neighbourhoods can benefit from a more diversified service supply to ensure a more balanced offering.
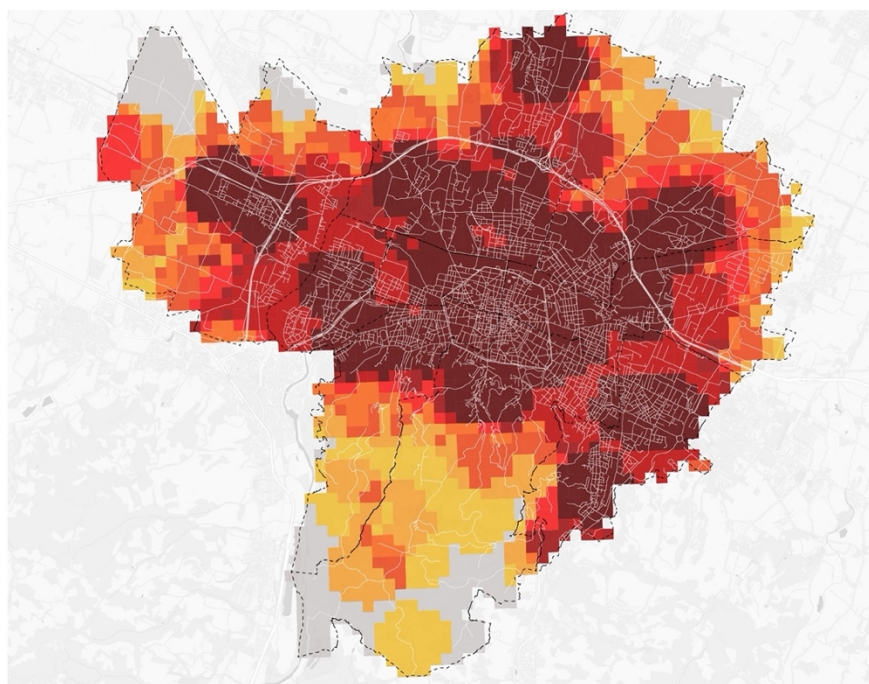
Figure 3. Compresence map of all proximity services for children. Source: Systematica.

Breaking down the service compresence map by service category reveals some additional insights regarding the distribution of each service category individually (Figure 4). In these maps, the areas marked in dark grey represent the areas in which at least one service in every service group is accessible within a 5-minute walk. The coloured zones are divided into two parts: the lighter shade in each map shows areas where at least one service in every service group is accessible within 10 minutes of walking while the darker or brighter shade shows areas in which at least one service of each group is reachable within a 15-minute walk. In contrast, light grey areas are those where none of the services within that service group are reachable within 15 minutes by foot. The 5-minute access areas are in fact similar for the 8 groups of services while the light and dark-coloured zones vary for each of the 8 groups. Analysing differences in coloured areas, we find that services such as community services are amongst the most widespread and well-distributed services, accessible in nearly all areas across the territory within 15 minutes. The same could be said of neighbourhood services and local shops to some degree. In contrast, cultural services (i.e. libraries, as defined in this analysis) are insufficiently accessible by foot in a major share of the territory.
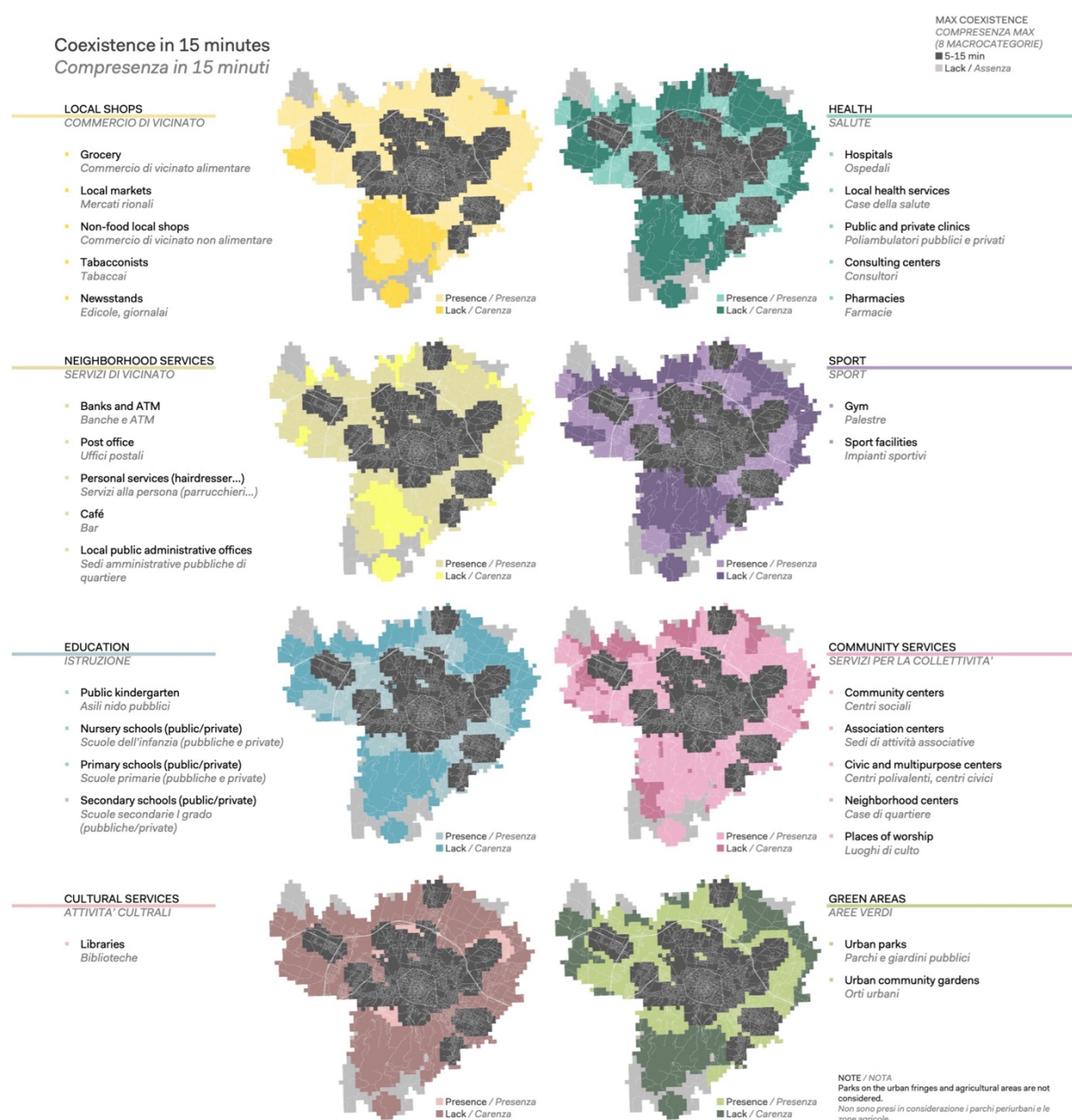
Figure 4. Compresence map of proximity services divided by category. Source: Systematica.

3.2. Walk Score analysis

Mapping the Walk Score analysis for the total population shows that highly walkable areas are mostly located in the central zones of the city. However, due to uneven population distribution across the territory, further analysis reveals that the majority of the population of Bologna (77%) live in areas with a high walkability index. In comparison, areas considered 'highly walkable' considerably shrink in the targeted Walk Score analysis for children. This result highlights the significance of a user-focused assessment of walkability. Conversely, tracking the locations of key destinations for the target users exposes some positive correlations. To elaborate, superimposing locations of schools in the city on the child-oriented Walk Score map reveals that about 90% of schools are already located in highly walkable areas. This finding is important in and of itself given the centrality of schools in children's daily lives as it guarantees a walkable experience in the vicinity of the school premises offering children coming from more distant areas the opportunity to access a wide variety of services on foot upon arrival to school.
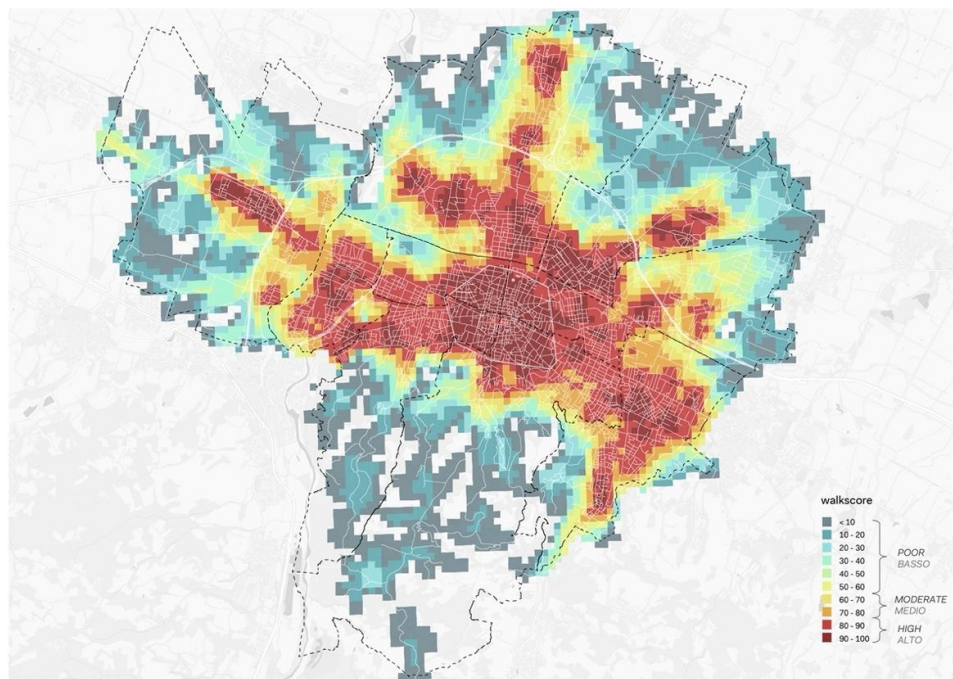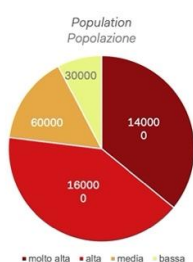
Figure 5. Walk Score analysis for the total population in Bologna. Source: Systematica.
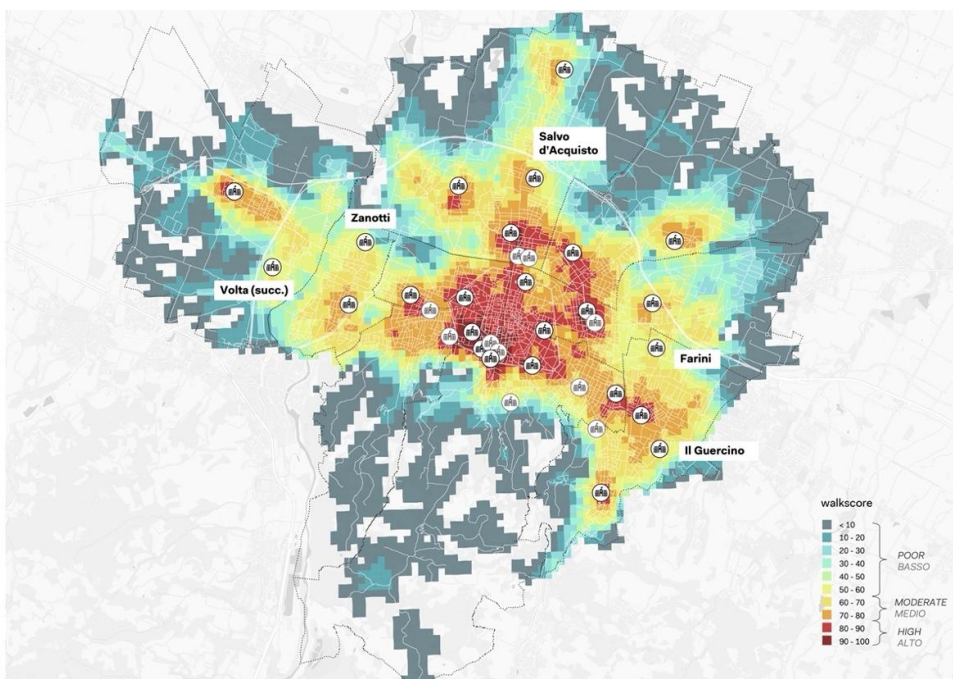

Figure 6. Walk Score analysis for the target group: 11-14 yo children. Source: Systematica.

4. Final remarks and future steps

In May 2021, the results of this research were presented at a roundtable discussion at the 6th Biennale dello Spazio Pubblico – BISP 2021, the biannual event dedicated to research, activities and practices devoted to public space. The 6th edition "I Bambini e lo Spazio Pubblico" focused on the theme of children, traversing topics from a wide variety of issues focusing on their access and engagement in the public realm of cities. The research intends to contribute to the UN target for Sustainable Development SDG 11.7 "*By 2030, (to) provide universal access to safe, inclusive and accessible, green and public spaces, in particular*

for women and children, older persons and persons with disabilities" (United Nations, 2015). Moreover, the research falls in line with local strategies such as the Bologna Sustainable Urban Mobility Plan (SUMP), which aims to "put people – and not vehicles - at the heart of the transport system" and promote "solutions that encourage new mindful life-styles and active mobility" (Metropolitan City of Bologna, PUMS Bologna Metropolitana and Comune di Bologna, 2019). More recently, the General Urban Plan (PUG) of Bologna, approved in July 2021 and entering into force as per the writing of this report, also highlights habitability and inclusion as its main goals for the city (Comune di Bologna & Sostenibilità è Bologna, 2021).

The studies presented in this paper represent the first step in a multi-scalar study to measure walkability for children in the city of Bologna. The project ranges from a macro-scale analysis of walkability at city scale to a micro-scale assessment of selected public spaces earmarked for intervention. The results discussed herein are part of the macro-scale analysis focusing explicitly on the first pillar of walkability as defined by Speck (2013), the *usefulness* of the urban environment, by relying on the 15-minute framework to evaluate accessibility levels. To complete the macro-level analysis future studies will be designed to test the remaining 3 factors –namely comfort, safety, and attractiveness– and will extend the target group to include children aged between 5 and 13 years old. The ultimate aim of this multi-scalar analysis is to implement suitable tactical urbanism interventions in the city at the local scale of the neighbourhood and monitor their impact using data collection tools over a suitable period of time in order to deepen our understanding of children's behaviours in the urban environment.

As shown in the preliminary findings discussed in this paper, the change of perspective from a universal user perspective to a specific user group changes the outcome for walkability significantly. In short, the results provide evidence that walkability for children requires targeted interventions and actions that consider their particular needs from the urban environment as well as their particular behavioural patterns. This paper focused on how the factor of age influences walkability potentials without considering intersectional differences. For example, gender has been shown to significantly impact children's independent mobility, especially at an early age (Greater London Authority, 2020; Shaw et al., 2015). Adding this layer of analysis would lead to even more socially attuned results, further highlighting the benefits of user centrality as a valid approach to measuring walkability in the city.

5. References

ARUP (2017). Cities Alive: Designing for Urban Childhoods. London. ARUP.

Comune di Bologna & Sostenibilità è Bologna (2021). General Urban Plan (PUG). Available at: http://dru.iperbole.bologna.it/pianificazione-governo-territorio/proposta-di-piano-urbanistico-generale-pug-lr-242017

Gorrini, A. and Bertini, V. (2018). Walkability assessment and tourism cities: the case of Venice, *International Journal of Tourism Cities*, Vol. 4 No. 3, pp. 355-368. doi: 10.1108/IJTC-11-2017-0072

Greater London Authority (2020). Making London Child-friendly: Designing Places And Streets For Children And Young People. London: Greater London Authority.

Hillman, M., Adams, J., & Whitelegg, J. (1990). One false move. London: Policy Studies Institute.

Korpela, K. (2002). Children's environment. In R. B. Bechtel, & A. Churchman (Eds.) Handbook of Environmental Psychology. New York: John Wiley & Sons, 363-373.

Metropolitan City of Bologna, PUMS Bologna Metropolitana and Comune di Bologna (2019). SUMP Sustainable Urban Mobility Plan of metropolitan Bologna.

Moreno, C., Allam, Z., Chabaud, D., Gall, C., Pratlong, F. (2021). Introducing the "15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities. Smart Cities 2021, 4, 93–111. Doi: 10.3390/smartcities4010006

National Association of City Transportation Officials & Global Designing Cities Initiative (2020). Designing Streets for Kids. Washington: Island Press.

Prezza, M., Alparone, F. R., Renzi, D., & Pietrobono, A. (2009). Social participation and independent mobility in children: The effects of two implementations of "We Go to School Alone". Journal of prevention & intervention in the community, 38(1), 8-25.

Speck, J. (2013). Walkable city: How downtown can save America, one step at a time. New York: Macmillan.

Shaw, B., Fagan-Watson, B., Frauendienst, B., Redecker, A., Jones, T., Hillmann, M. (2013). Children's independent mobility: a comparative study in England and Germany (1971-2010).

Shaw, B., Bicket, M., Elliott, B., Fagan-Watson, B., Mocca, E., Hillman, M. and Fagan-Watson, B. (2015). Children's Independent Mobility: an international comparison and recommendations for action. London Policy Studies Institute.

UN General Assembly (1989). Convention on the Rights of the Child. United Nations, Treaty Series, 1577(3), pp.1-23.

United Nations (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. New York: UN Publishing.

World Health Organization (2020). Fact Sheet: Physical Activity. WHO. Available at: who.int (accessed on 13 April 2021)