urban science

Review

The Healthy City Reimagined: Walkability, Active Mobility, and the Challenges of Measurement and Evaluation

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Abstract: Recently, there has been a growing interest in exploring the relationship between walkability and various aspects such as health, urban planning, and sustainability. This interest stems from the acknowledgement of the impact of walking on issues such as obesity, pollution, and other diseases, even if these are only weakly correlated. This scoping review was carried out to shed light on the link between walkability and health. The main objectives of this review are to describe the tools used to evaluate walkability, to highlight the variations in measurement methods, and to offer a critical evaluation of these tools. The final analysis includes a review of the most recent and comprehensive studies and online resources. Finally, an evaluation of the tools was carried out, with a focus on urban and architectural expertise relating to design, functions, and activities in public spaces, analysing the few available bibliographic references that correlate walkability with measured health outcomes using validated tools and health information flow. Neighbourhood walkability is influenced by the availability of functional amenities, activities, and safety. Failure to consider its importance on human health could lead to urban social inequalities and thus failure to create salutogenic cities, which could have major implications in terms of public health.

Keywords: walkability; public health; assessment; health impact; measurement; environmental health; urban planning; equity

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1. Introduction

Walkability is defined as the degree to which an environment is conducive to pedestrian movement, characterised by factors such as safety, accessibility, and attractiveness. Enhancing walkability in urban planning contributes positively to public health, quality of life, and environmental sustainability while also reducing reliance on automobiles and promoting sustainable transportation solutions [1–3].

The enhancement of walkability in urban planning contributes positively to public health [4].

The significance of walkable spaces plays a crucial role in reshaping urban environments, serving as the primary mode of mobility and the initial way of experiencing the urban landscape. Consequently, prioritising walkability is essential in urban design due to its numerous advantages in terms of health, quality of life, and environmental sustainability, as well as social benefits [5].

Hence, real planning of forms of mobility is necessary in urban contexts, and pedestrian mobility is no exception. Indeed, planning and programming are not enough; it is a priority to involve the whole population in order to provide tools for social inclusion and combat marginality.

There is a convergence of intentions between local institutions (municipalities, Local Health Units—LHUs) and the third sector (especially local associations). All these actors are moving forward in synergy, particularly with regard to “school zones”, starting with work on school footpaths. Examples of this are the work that the Municipality of Rome is carrying out with multiple structural interventions (although for now concentrated in the most central areas of the city) and the National and Regional Prevention Plan [6], which envisages such action in various programmes in order to encourage the active mobility of the school population.

Acting on walkability requires the intersection of several factors and requires the involvement of several professionals to define a complex and multidisciplinary work. In particular, LHU Roma 1 undertook this scoping review to support the work it has carried out to strengthen the development of the pedestrian friendliness theme in terms of public health and professional training in urban health promotion. The work carried out by LHU Roma 1 estimated the walkability index by means of direct measurements, that is, through assessing the correlation between urban architectural variables and the prevalence of diseases, notably Diabetes Mellitus type II [7].

A number of studies have emphasised the need to analyse urban environments in a way that takes into account the complex dynamics, historical layers, and basic knowledge of the complexities that exist within cities and how they have evolved as organic entities [8]. This approach advocates for multidisciplinary tools beyond just architecture or public health, requiring a continuously evolving knowledge base and methodologies to enhance both the physical and abstract well-being of individuals, ensuring their health and overall quality of life [9].

Moreover, other studies aimed at promoting active mobility should consider a wide range of factors, including physical aspects related to design as well as intangible elements such as the functionality, comfort, and aesthetic appeal of the environment. These aspects are intricately connected, revolving around a concept of public and pedestrian spaces that prioritise active mobility and human presence over private vehicle use [10].

Research indicates the importance of emphasising walkability to encourage walking effectively, thereby strengthening the urban environment as a social gathering space. Cities serve as venues for social interaction, personal and communal growth, economic activities, and knowledge exchange, all driven by the diversity and complexity inherent in urban settings [8,11].

In this sense, one of the most important theoretical foundations can be traced back to the work of Jane Jacobs. Jacobs presents a comprehensive perspective on the challenges and solutions for creating vibrant and liveable urban areas with characteristics like vitality, diversity, and aesthetic appeal, aiming to foster pedestrian-friendly cities and establish a sense of “urban familiarity” [10].

Some academic research underscores the duality present in urban environments, with a particular focus on the relationship between the physical fabric of a city (buildings, roads, infrastructure, amenities, and furnishings), the intangible qualities that contribute to its liveability (pleasantness, perceived safety, aesthetic appeal, and comfort), and ultimately the interplay between “solids” and “voids” that shape a city as a lived environment [12]. This duality is further emphasised by Gehl’s concepts, suggesting that the essence of a city lies in the spaces between buildings, such as streets, plazas, and structures. All of these significantly contribute to promoting walkability and shaping the aesthetic appeal of a space, ultimately determining its quality [13]. Many other researchers have focused on these topics, adding other contributions to the discussion and the development of more recent interpretations [14,15]. However, there is a gap in the literature linking the urban architectural elements behind “walkability” and “health outcomes”.

The recent literature reflects a growing interest in walkability, particularly its association with physical health and urban environments. Studies have explored various facets of walkability, linking it to socioeconomic variables and health indicators [9]. This review integrates multidisciplinary perspectives, highlighting the need for a more holistic approach to understanding walkability's impact on public health.

Only a limited number of researchers, and only in recent times, have directed their attention towards an objective dimension of health, commencing with the walkability of an area, such as census tracts [16], or the vicinity surrounding the domicile of the individuals encompassed in the research, derived from prevailing health records [17]. Nonetheless, numerous investigations have concentrated on the correlation between walkability and obesity within a clearly defined demographic [18,19]. Several other studies scrutinise the link between walkability and environmental contamination [20,21], which functions as an intervening variable in the causal sequence for persistent respiratory ailments. Moreover, further research delves into the connection between the walkability of regions and the genuine inclination towards walking among the populace [22] or in correlation to the communal resources of societies, gauged through involvement in communal or associational undertakings [23] or backing for the elderly [24]. Overall, the established correlations are either absent or feeble, hinting that some factor is still not included in the model.

This scoping review was undertaken to redress previous studies, especially in the US, where administrative and commercial tools were used to measure walkability. The Local Health Unit (*Azienda Sanitaria Locale—ASL*) Roma 1 wanted to explore this further to support the matter of increasing the promotion of walkability, taking into account the different architectonic barriers that an urban context can also present from a safety point of view. This need arises from the institutional mandate linked to the National Prevention Plan 2020–2025, a comprehensive prevention governance tool, to develop health promotion interventions through the focus areas of urban health and equity [6].

In this sense, this study focuses on an extensive research approach aimed at categorising tools according to their purpose, delving deeper into the evaluation of elements related to health outcomes measured by the occurrence of diseases or conditions. The results thus present a categorization into administrative, commercial, and biomedical/academic tools, in line with the previously stated requirements of this research.

This study employs a narrative and qualitative review approach, focusing on how various actors—including institutional, commercial, and academic sectors—have developed the concept of walkability in relation to health outcomes.

2. Materials and Method

Selection of Articles

The aim of this review is to give an umbrella perspective rather than an exhaustive analysis; therefore, the emphasis is on breadth over depth. A comprehensive search was conducted across major biomedical databases (e.g., PubMed, Scopus, and Web of Science) as well as general web searches to identify relevant tools, studies, and experiences.

The search strategy comprised a search for the title, abstract, and keywords. The keywords used were "walkability" AND "health". Only articles that included any type of measurement for walkability and its link to health that were written in English or Italian were included.

The results of the initial search comprised 5526 articles, which then needed to be screened on whether they followed the criteria required. All of these records were screened, and any duplicates were discarded. After having selected the articles that complied with the aim of this research, only 67 articles were included. Of these, only 42 were considered eligible (Figure 1) [25].

However, most of the articles found cited the link between walkability and its benefits on health, but none specifically mentioned the link between the measurements of walkability and the health impact. In order to give a broad view to focus on the different available tools, both administrative and commercial, as mentioned below, and their measurement of the influence of walkability on health, a narrative approach was used to analyse the results.

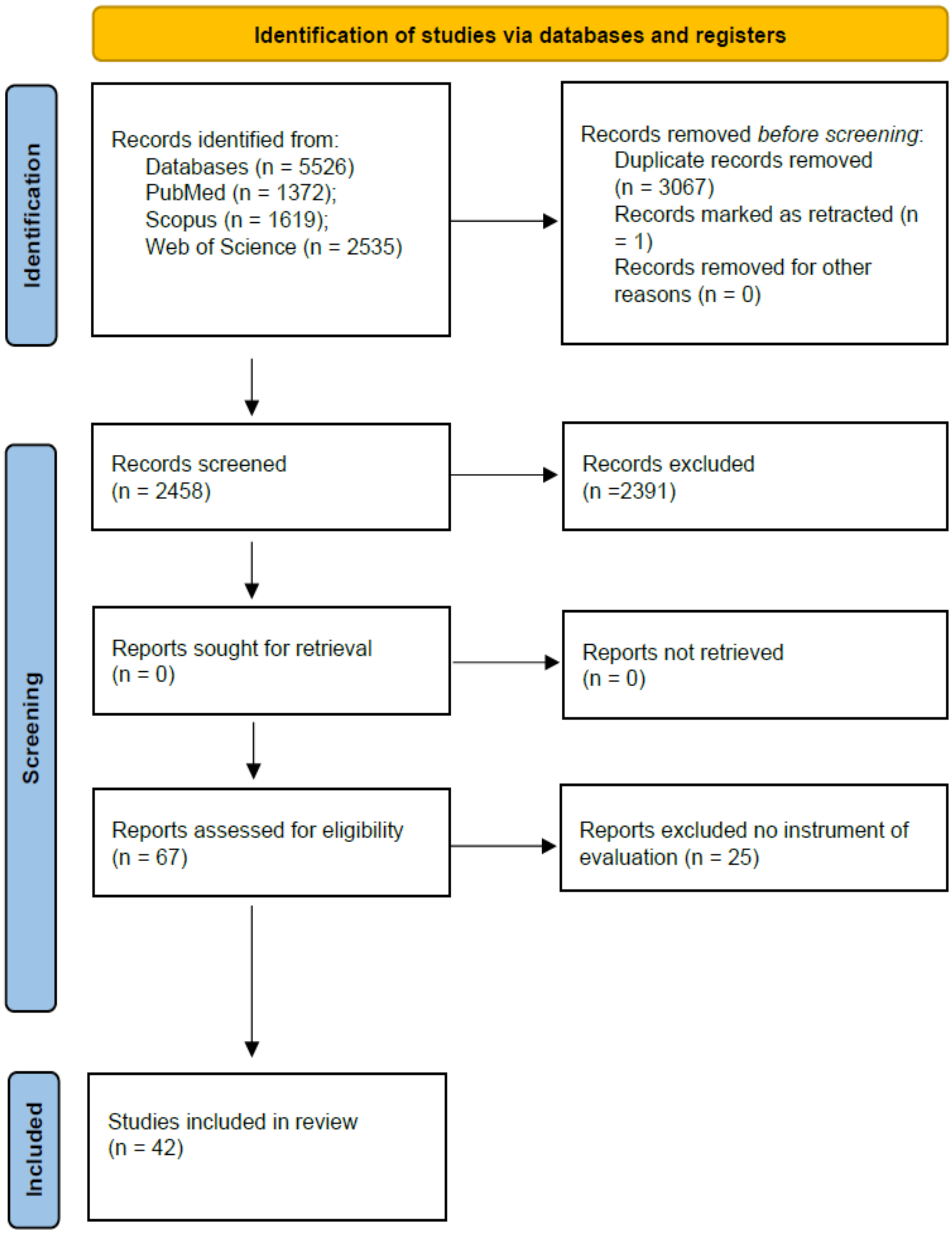

Figure 1. PRISMA flowchart: search and selection of articles.

3. Results

3.1. Tools for Measuring Walkability

Walking in cities is a complex phenomenon influenced by several factors. One study [26] has tried to systematise scientific production in this area, showing that, as of 2018, the topic has been contributed to by more than 400 authors from 33 different countries, with a particular prolificacy of work from the United States, Canada, Denmark, the United Kingdom, New Zealand, and lately China. The study highlights the interdisciplinary nature of the topic, encompassing urban science, health, and socioecological perspectives.

The walkability of neighbourhoods and cities is influenced by various factors, encompassing both tangible and intangible aspects of urban life. In order to facilitate walking, certain prerequisites must be met, including the availability of functional amenities and activities, ranging from parks to local businesses [27]. Additionally, sidewalks should be wide, safe, and pleasant, catering to different weather conditions and equipped with appropriate furnishings, such as parking facilities. These considerations pertain to both material and planning aspects. However, enhancing the walkability of spaces also involves an aesthetic dimension, influenced by the design and layout of buildings, streets, and squares. Safety is another crucial aspect, encompassing physical safety, such as preventing traffic accidents, and perceived safety, such as addressing concerns related to crime. These factors are influenced by social and economic dynamics, which contribute to the development of a vibrant and diverse urban life [28–31]. Furthermore, mobility plays a significant role, as walking serves as the foundation for any journey, whether it involves public or private transportation. This issue is closely linked to environmental sustainability and reducing pollution.

Few and only recent studies have concentrated on an objective measure of health status, beginning with the walkability of census sections [16] or the neighbourhood surrounding the homes of the study's population based on available health data [17]. Instead, many studies have worked on the association between walkability and obesity on a well-defined population [18,19]. Other research examines the connection between pollution and walkability [20,21], utilised as a mediator in the chain of events leading to chronic respiratory illnesses. Some studies, however, examine the connection between the population's actual inclination to walk and the walkability of certain areas [22] or its connection with the social capital of communities, as determined by involvement in associational or community activities [23] or in aiding the senior citizen community [24]. Generally speaking, these associations are negligible or weak, suggesting that the model may still be missing some factors.

An additional potential constraint on these investigations could be the tool employed to assess walkability. Generally speaking, the most widely used tools have features that allow them to return a measurement remotely through evaluations in a GIS environment. Despite being incredibly simple to use, this tool's main drawback is that it reverses the perspective. In fact, walkability as it is understood relates to a small city and to a city as viewed from below, and remote measurements only serve to replicate a model of observing and analysing the urban environment from above, from a perspective other than that of the people. As such, GIS tools are limited not only by data updating but also by extrapolating the measurement area from the context and failing to consider the "intangible" aspects of the urban environment, which we have observed to be crucial in creating a pleasant, functional, and vital space [32]. However, these tools also have certain features that make them highly useful. Most importantly, they are simple to use and replicable, making them immediately applicable on a large scale.

In the USA, economic, political, and social dynamics have an impact on the urban sphere through the economic trends of the real estate market [33–36]. Thus, it is in this sense that we find two distinct approaches to assessing walkability, which, while having different goals, ultimately serve the same purpose of improving properties.

As part of a goal to measure efficiency in the location of a built environment, the United States Environmental Protection Agency (EPA) has developed the National Walkability Index (NWI), an extremely user-friendly and effective walkability indicator in planning terms. The focus of this study is exclusively "environmental," as walkability is measured in relation to other metrics concerning commuter routes to and from home, as well as the Smart Location Database, which evaluates, within census divisions, factors pertaining to an area's general effectiveness in terms of housing density, accessibility to public transportation, and other factors. The NWI can be reconstructed from this database using three main factors: the functional mix, which is further broken down into destination use and destination use plus residential, the density of intersections, and the density of public transportation stops [37]. A result ranging from 1 to 20 is returned by the NWI measurement at the census section level, allowing for the division of walkability into four classes (1 low, 20 maximum). Owing to its user-friendliness and extensive data availability, the tool facilitates an efficient preliminary evaluation of contexts that are valuable for organising and setting priorities for intervention areas.

In addition to this institutional tool, the US real estate industry has made a significant investment in creating, supporting, and distributing a second walkability tool, spread through academic publications and scientific institutions.

The substantial interest of key real estate stakeholders in neighbourhood walkability is evident, as major US real estate firms have invested in and utilise precise measurement tools. This has significant ramifications for the advancement and generation of scientific and biomedical literature. WalkScore®, a metric widely used in academia and real estate, was created by a Seattle-based startup and later acquired by Redfin. Zillow also incorporates WalkScore® data on its platform. WalkScore® has since added TransitScore® and BikeScore® [38], and these metrics have been validated by numerous studies [39]. While the exact algorithm remains proprietary, it is known to utilise data from sources like OpenStreetMap to assess walkability, transit access, and bikeability [40]. Therefore, in this sense, the score allows one to evaluate walkability within a one-mile radius of a set of designated points, thereby enabling real estate market participants to compute the walkability of urban neighbourhoods. From this vantage point, the index is also promoted for inclusion on the websites of real estate companies, enabling them to evaluate the walkability of neighbourhoods' surrounding properties for sale.

This index has been utilised by Redfin in particular for several industry studies, demonstrating how prices in "walkable" neighbourhoods have precisely increased over the 2000s in comparison to "car-dependent" neighbourhoods [41–44]. In general, Redfin's research is carried out at the neighbourhood level at times and at the level of US cities at other times. Therefore, it is clear how challenging it can be to comprehend some of the finer-grained dynamics operating in cities with these comparisons at such high scales. Similarly, it is also evident how the walkability of cities or neighbourhoods affects two crucial aspects—equity and urban rents—which are unquestionably linked [36]. One of the primary mechanisms of urbanisation economy, or spillover to the territory in the form of interventions, plans, but also functions and uses, of socioeconomic dynamics acted by actors at different levels is the rent gap between more central and more peripheral neighbourhoods. This gap is not solely one from a geographic point of view but also one from an economic, social, cultural, or symbolic point of view [45]. An analysis and evaluation of walkability cannot be separated from liveability, environmental resilience, urban accessibility, and health.

Regarding Italy, this debate remains largely confined to the academic sphere, partly due to the lack of actors interested in or having a clear understanding of urban issues from a social or economic perspective. Regarding this, the main tool—the "15 Minute City Index"—was created by Enel X, a company under the ENEL S.p.A. group. Its purpose is comparable to that of the institutional ones created by the US EPA. Using a grid of "micro-districts", or square polygons with a side length of 700 m, public administrations can evaluate an index based on 49 components expressed in 13 dimensions (health, mobility, entertainment, etc.) using this free tool. The tool integrates user-generated georeferenced data, open data, and computer vision-analysed satellite images. The final result is an index that can be readily used and understood. This is especially useful for macro-planning interventions related to the distribution of services and functions [46]

Both institutional and commercial approaches, despite having different objectives, enable a definition of walkability in areas based on elements analysable at the urban or neighbourhood scale, invariably utilising GIS as an analytical tool. This, however, is only feasible in the presence of a robust and updated underlying database.

In conclusion, the tools used to measure walkability can be subdivided into structural tools [27,28,31], health measures [16,21], personal attitudes to walking [22,24], GIS tools [32], economic, political, and social dynamics [33,36,45], the National Walkability Index [37], "score" measuring [38,40], and the impact on "construction" [41,44–46].

3.2. Evaluating the Health Impact of "Walkability"

As stated earlier, there has been a rising interest in "walkability" and the health impact that it can bring, and, nowadays, the measurement of "health outcomes" and "health benefits" is of great importance in research. For example, since 2000, when research first began, until now, more than 1300 studies have been published regarding "walkability" and "health". However, as stated earlier, there is a general gap in the literature with regard to the association between the urban architectural variables of "walkable" and "walkability" and health outcomes measured through epidemiology [47].

A basic difference between urban studies and biomedical research that can make interaction difficult pertains to "evidence". For example, the nature of evidence used in urban studies to develop policy is different from that used in epidemiological studies. However, as noted by Kent et al. [48], "..*it must be recognised that the way people live and move around a place cannot be subject to the methods employed to produce the standard of evidence traditionally used to underpin health policy decisions*. . ..".

A frequently overlooked aspect, yet one that emerges implicitly in numerous urban studies as well as some biomedical research, pertains to the issue of equity [49,50]. While this concept is well analysed in social epidemiology and understood by urban planners, a unifying perspective between these two theoretical fields remains elusive. From a strictly statistical viewpoint, we can affirm that social inequalities are a confounding factor in the relationship between the urban environment and health, as they are directly linked to both variables: higher-quality neighbourhoods are often wealthier neighbourhoods, which in turn are also those where the "healthiest" populations reside [35,50]. In this sense, it is crucial to remember that urban and architectural interventions should incorporate components of "urban equity" to mitigate social inequalities in health. Even if the relationships between the quality of the surrounding urban space and psychophysical well-being, as well as the relationship between other individual elements such as greenery, pollution, heat islands, and health itself, have been demonstrated with the use of questionnaires or audit tools, there is a lack of sufficient evidence linking the urban architectural elements behind "walkability" and "health outcomes" [5,47,51].

In general, there are numerous health impact assessments of urban transformation or urban planning interventions available, which can include the reorganisation of the transport system. These assessments, however, are intended in the Anglo-Saxon sense of health impact assessment (HIA), a tool modified in terms of its methodology, including some interesting insights for its application in the specifics of urban settings [52,53]. However, these assessments are not suitable in the Italian context. Italy is characterised by a strong regulatory rigidity with regard to the application of environmental and health impact assessment tools [54].

The majority of these HIAs focus on the issue of mobility, particularly cycling infrastructure, which can generate a lot of health benefits, such as increased physical activity and a reduction in the number of road accidents, as well as economic benefits. It has been widely demonstrated that an overall improvement in the urban environment, in terms of pleasantness, greenery, and safety measures, as well as accessibility and active mobility, can allow for a better use of space and thus increase the effectiveness of health outcomes and reduce mortality related to non-communicable diseases, which include cardiovascular diseases, diabetes, mental health, and respiratory diseases [18,21,47,49,51,55,56].

The full use of public areas/space is enhanced by the presence of greenery and increased accessibility to public transport, while on the other hand, one of the main obstacles in its critical aspects remains the issue of road safety. Some researchers have tried to associate the characteristics of the urban environment with the health status of the population, albeit in general terms. It has been demonstrated that the incidence of many non-communicable diseases, such as diabetes, is reduced in areas that are highly walkable compared to those areas that are less walkable [52,57]. With regard to walkability, in terms of the exposure variable, all of these studies use parametric tools that calculate variables remotely using GISs, all of which are variants of the "National Walkability Index" or the

WalkScore® [38,39]. Walkability is thus analysed in terms of services in the neighbourhood, also defined as "walkable destinations", street connectivity such as intersections, and the population density in an area [58], effectively grounded in Jacobs' principles of urban diversity and vitality. Other studies also included other factors such as the presence of schools and housing density. Scores are based on a small population unit associated with the Italian Census Unit and are calculated on a scale from 0 to 100, divided into quartiles. None of these studies analysed included a field analysis but only the use of GISs to remotely calculate the variables that make up the walkability index. One study also analysed socioeconomic status as a covariate [56]. This method of calculating and evaluating the index by means of a GIS is widely used in studies associated with health outcomes. This could be presumably due to the ease of retrieving information and the subsequent record linkage obtained, especially in large populations.

Furthermore, this also allows for a stratification into quantiles, which can be useful for carrying out subsequent regression analyses. In all of the studies analysed, the score was correlated with health outcomes, measured in terms of blood pressure and the risk of hypertension [59], cardiovascular risk [60], and obesity [58], with a small quantile relationship with regard to diabetes. There were small variations in the lowest quantiles of walkability and a jump in the decrease in prevalence between the lowest and highest quantiles, and it appears that there were nonlinear interactions, which need to be further investigated in relation to ethnic groups and metabolic diseases in pregnancy [61]. In the US context, there is a great focus on ethnic groups, as this often corresponds to a lower socioeconomic level and living in deprived neighbourhoods. However, in a study based in a European context, walkability was found to remain inversely correlated to the prevalence of type II diabetes, even after adjusting for socioeconomic area variables, but not for individual variables [56]. A multi-varied cross-sectional model demonstrated that increased walkability can be associated with a lower BMI score in children and adults, and it is quite important to analyse this with further research [62,63].

Thus, the tools used to assess the health impact are epidemiological tools [47], equity-based tools [35,49,50], health impact assessment [52–54], socioeconomic status [60], and, finally, the reduction in mortality related to non-communicable diseases [18,21,47,49,51,52,55,59,61–63].

Overall, notwithstanding the considerable interest in the subject, there are very few studies which have assessed a direct association between walkability, however measured, and health, in terms of disease prevalence or the health status of the population.

There are two main limitations; firstly, like most of the literature regarding environmental epidemiology, these are studies which analyse association not causation. This is due to the fact that it is not possible to establish a causal relationship within complex systems such as urban ones, as the factors intersect and interact with each other in many ways which are not even measurable. The intersectionality of these studies, as well as the ability to integrate qualitative and quantitative assessments, makes it possible to obtain evidence that can allow for targeted interventions with the aim of improving health. The other main limitation is the temporal distance between exposure and pathology, a problem found in relation to most chronic degenerative diseases. It takes, as in this current study, years, if not decades, of exposure to a sedentary lifestyle to develop metabolic or cardiovascular diseases; therefore, the most suitable type of study is still a cross-sectional one.

4. Discussion and Conclusions

"Walkability" can help reach nine different sustainable goals stated in the WHO 2030 Agenda, such as SDG3" Good Health and Well-Being", SDG4" Quality Education", SDG5" Gender Equality", SDG7" Affordable and Clean Energy", SDG9 "Industry Innovation and Infrastructure", SDG10" Reduced Inequalities", SDG11 "Sustainable Cities", SDG12 "Responsible Consumption and Production", and SDG13 "Climate Action" [63].

The aim of this study was to provide a multidimensional view of health outcomes with respect to walkability and the availability of the validated tools used to assess it in relation to the promotion of physical activity and consequently evaluating the health status of the general population. Such a scoping review reinforces our previous experience and work as part of the Local Health Unit Roma 1, within the activities outlined in the National Prevention Plan 2020-25. It also enables us to highlight the differences between different urban contexts, linking accessibility and urban architectural determinants, and how they affect both public health and road safety, which will be quite useful in the future development of new tools to be used for measuring impact and interventions.

This study also attempts to critically analyse the different tools and methods used and their limitations. The tools analysed not only consisted of the most recent research and comprehensive studies but also online sources made available, which also included field research, mainly focusing on the references that correlate the relationship between walkability and the health outcomes analysed using these validated tools. The evaluation of the studies highlights that actually being able to measure factors correlated with walkability is a complex process, as it involves material, immaterial, and symbolic dimensions, as well as sociocultural aspects, in the perception of urban space, which vary in time and space.

As already mentioned, the majority of the studies analysed used scores or indicators, such as a GIS, the NWI, and WalkScore, which allow for easy calculations to be carried out remotely, which can establish a link between walkability and macroscopic factors linked to urban planning. Unfortunately, this does not allow for a correct evaluation of microscopic or minimal factors, which can influence everyday activities and therefore highly influence the walkability [32,38,39]. Furthermore, the European, specifically Italian, context is different to that of the United States, especially in terms of development trajectories, urban planning, and practises; therefore, the tools which are strongly influenced by these cultural, urban, and social differences must be calibrated to the characteristics of these different contexts. For example, in relation to mobility and cars, in major European cities or in the US or Asia, it is quite unusual to find cars parked on the pavement, close to public transport stops, or even at crossroads, which can cause an obstacle to pedestrian transit and active mobility, especially for fragile categories. This, unfortunately, is the norm in Rome or in other Italian cities, and a GIS remote instrument cannot calculate this. Another limitation would be the reliability and modifiability of the data source, especially for indices such as WalkScore®, which uses variables such as the presence of commercial activities. There could be discrepancies between the perception of the urban environment and the measured score both in terms of over- and under-estimation [64].

It is challenging to structure a general synthesis regarding the analysed tools based on the type of work. In general, all the studies identified in the biomedical literature search highlighted how environmental analysis has always been conducted at a "macro" level, that is, using variables measured remotely and not directly in the field through site visits. In this sense, in accordance with what was previously stated regarding the importance of factors at the "sensory" level and therefore associated with the proximal urban environment rather than general planning, there is a gap in scientific evidence.

Actually, the action of walking consists of a lot of variables, which include motivation, needs, and the availability of an attractive, favourable surrounding, which can create a welcoming context. Also, personal relationships and neighbouring areas must be taken into account, as this provides a sense of security and belonging to a place and also triggers the desire to explore a more active lifestyle. All this shows how measuring factors correlated to walkability can be very complex, as it brings into question both material and immaterial factors as well as cultural and social aspects of the perception of the surrounding urban space, which can vary in the same person over time and space. Trying to generalise tools validated with in-depth statistical evaluations consists of complex theoretical evaluation and thus is difficult to carry out in terms of obtaining results.

Once again, the theme of causal links and statistical associations is raised, recognising in this an intrinsic limitation of all the scientific literature in this field and a growing need to intersect transdisciplinary knowledge and technical skills.

For future research and future urban planning, from a public health point of view, an improvement in the available statistical methods used to measure the link between walkability, the environment, and health outcomes is needed. There is a need for a multimethod approach for a better holistic picture of the territorial area and the health and environmental impact of walkability, and there is also a need for innovative methods to measure walkability.

One must also not forget the union between the different aspects of policymakers, governance, and health in order to reach the single end goal of a sustainable world [63,65].

Looking forward, it is essential to explore further the impact that the urban world has, comprehending not only the architectural and landscaping dimensions but also the economic, cultural, and social aspects, on the diverse opportunities available for people who walk.

Future research endeavours should also evaluate the efficacy of particular interventions and partnerships established between public health entities, educational establishments, and urban stakeholders, which are pivotal for devising and executing strategies aimed at enhancing the well-being and health of the population. It is important to include the "walkability" criteria in urban planning requirements, with a special emphasis regarding the health of the population, integrating both medical and architectural-engineering expertise. By doing so, it makes it possible to improve people's well-being, be it in physical, psychophysical, economic, or cultural, as well as reducing the burden on the national health care system in the long run, resulting in reduced economic expenditure. It is absolutely necessary that validated scores be used to define the impact of walkability on health and the validity of the measures undertaken.

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