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**DOCTORAL DISSERTATION**

# **Sport for Everyone**

**Evaluating Accessibility in Outdoor Public Spaces with  
Attention to People with Disabilities**

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## Summary

Outdoor public spaces have become increasingly popular venues for promoting sports and physical activities for everyone. This thesis examines how these public spaces can motivate all individuals to engage in sports activities, particularly those with disabilities. The research emphasizes the rising demand for accessible outdoor public spaces such as streets, parks, and play areas, taking into account the growing number of people with disabilities and their low levels of sports involvement and physical activity. The thesis identifies critical barriers resulting from the physical design characteristics of public spaces that hinder disabled users from participating.

The thesis is designed around four main research questions: factors influencing the creation of inclusive sports cities within public spaces; physical barriers faced by people with disabilities in running environments; necessary design interventions for revitalising inclusive recreational spaces in the Chorzów Activity Zone in Poland; and a comparative analysis of accessibility and usability in recreational areas across Hungary, Poland, Iraq, and Saudi Arabia. The methods employed in this thesis include case studies, surveys of 110 individuals with disabilities, and comprehensive literature reviews. Principles of universal design alongside international and national accessibility standards were applied to assess the accessibility and usability of the revitalisation of outdoor public parks and play spaces in various countries.

The findings of this study underscore the significance of surface quality, inclusive elements, facilities, safety, and proximity in outdoor public spaces. This research advocates that urban planners, practitioners, and policymakers enhance their awareness regarding the implementation of accessibility standards, involve individuals with disabilities in the planning process, and collaborate with disability advocacy organisations. It concludes that the design of accessible outdoor spaces inspires everyone to participate in sports and physical activities.

Eventually, this thesis contributes to the enhancement of inclusive, lively sports cities that welcome individuals of all ages and abilities. It promotes better policy frameworks and practical guidelines to ensure the universal accessibility of public recreational spaces, fostering social integration, well-being, and community health.

# **Sport for Everyone:**

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# **CHAPTER 1**

## **INTRODUCTION**

## **1.1 The importance of trends and policy developments in promoting accessible sports for all in outdoor public spaces, including individuals with disabilities**

Sports for All is a concept that promotes equal access to sports and physical activities for everyone, regardless of age, gender, ability, or socio-economic status. It focuses on mass participation rather than competition, encouraging everyone to engage in sports for health, well-being, and social benefits [1–7]. According to the World Health Organisation (WHO), over 1 billion people, or approximately 15% of the global population, live with some form of disability [8]. Along with an ageing population and increasing chronic health conditions, the number of individuals with disabilities is rising [8, 9]. Furthermore, the rates of obesity, cardiovascular disease, and physical inactivity among people with disabilities are higher than those for able-bodied individuals [6, 7, 10]. Therefore, studies have demonstrated the importance of involving individuals with disabilities in sports and physical activities, which can enhance their physical, mental, self-esteem, and social well-being [10-14].

For many years, policies aimed at shaping the trends of inclusive sports cities have gained popularity [15]. These policies have focused on boosting sporting participation and physical activity levels to promote health [16] and ensure that sports programs are accessible to all [2, 17, 18]. Particularly, policies have targeted vulnerable groups, such as individuals with disabilities, due to their lower rates of physical activity and sports participation [19]. In recent years, there has been a shift toward individualised sports participation; activities such as running, cycling in public spaces, and outdoor gym workouts (known as “light sports”) have gained significant popularity. Participation in these flexible and informal activities has increased more rapidly than in traditional, organised sports clubs (known as “heavy sports”) [20-22].

Scholars and policymakers have increasingly recognised that public spaces, such as parks, squares, playgrounds, and natural areas, play a significant role in promoting active lifestyles and sport participation [23]. In addition, municipalities have aimed to create a more appealing built environment that inspires people to engage in physical activity [23-25]. In regard to these, urban public spaces have been developed to accommodate various sporting activities and facilities, including informal and unorganised sports such as running, cycling, parkour, yoga, boot camps, gyms, and other urban sports [26–28]. In developed countries, there is a growing recognition of the role of sports in urban planning, leading to policies that promote sustainable

cities with convenient access to outdoor sports facilities. Public spaces often attract more people to engage in physical activities than formal sports settings inside buildings [29, 30]. Despite efforts to create inclusive sports environments in public spaces, there is limited understanding of how these outdoor areas can enhance accessibility and active lifestyles, particularly for individuals with disabilities [31, 32]. This thesis investigates and evaluates the accessibility and usability of urban public spaces, including streets, parks, recreational areas, play spaces, and playgrounds, for all individuals, with a special focus on people with disabilities.

However, individuals with disabilities often encounter challenges in accessing and using these environments [33-36], mainly due to design, environmental, and safety barriers that limit their participation [37]. Despite the well-known benefits of sports and physical activity, urban public spaces are frequently designed with able-bodied individuals in mind, often failing to accommodate the needs of people with disabilities [38, 39]. Studies have highlighted the presence of physical barriers in public spaces that significantly hinder accessibility, making it difficult for individuals with disabilities to navigate built environments and participate in daily activities, including sports and exercise [40-49]. There is increasing attention to ensuring accessibility for diverse populations, with an emphasis on providing equal opportunities for societal engagement [51-53]. Universal design, which aims to accommodate a wide range of people, promotes inclusivity in urban environments [50]. Universal design principles and international and national accessibility standards guide the design of outdoor spaces to enhance accessibility, enabling people with disabilities to move independently. There is still neglect in implementing physical characteristics in many revitalised public spaces and recreational areas in Iraq and Saudi Arabia compared to Poland and Hungary due to a lack of awareness, government regulation or enforcement, training and expertise, as well as cultural attitudes that caused misunderstanding about disabilities. As a result, individuals with disabilities continue to face challenges in participating in sports, events, and physical activities.

This thesis aims to explore the significance of sports for all and examines the relationship between the physical characteristics of outdoor public spaces and individuals with disabilities. It evaluates the accessibility and usability of various outdoor sports facilities based on universal design principles and accessibility standards, assessing how these factors encourage sports participation among diverse groups, particularly individuals with disabilities. The findings may inform local authorities and practitioners about the need to reconsider incorporating universal

design and local accessibility standards in recreational and outdoor areas to promote sports participation for people with disabilities. Additionally, it will require the participation of individuals with disabilities in the design process for revitalising recreational areas to better meet their needs. For instance, it may assist in determining public space interventions through improved accessibility and usability of play and sports equipment, creating inviting environments that promote equitable participation in sports for everyone. Furthermore, this approach will contribute to the development of inclusive sports cities and enhance the well-being and self-esteem of individuals with disabilities.

This introductory chapter establishes the broad context and rationale for the research. Section 1.2 provides an overview of trends and developments in policies related to sports cities and the use of outdoor public spaces for sports, with a focus on individuals with disabilities. Section 1.3 highlights the gaps in existing literature that this thesis aims to address while outlining its conceptual framework. Section 1.4 presents the overall aim of the thesis and its research questions. Section 1.5 details the research design, while Section 1.6 provides an outline of the subsequent chapters.

## **1.2 Research Gaps and Conceptual Framework**

There is insufficient research exploring the relationship between people with disabilities and the physical characteristics of urban public spaces in the context of sports participation. Despite existing literature on universal design and accessibility standards, many renovated recreational and urban public spaces still fail to fully accommodate the needs of people with disabilities in sports settings. This dissertation seeks to address the following three key research gaps.

First:

In modern urban society, sports have become a vital part of daily life, which takes place in public spaces such as streets, parks, squares, playgrounds, and natural areas. Over the years, scholars and policymakers have become increasingly aware of the impact of designing public spaces on promoting sports participation [23-28]. However, despite this growing awareness, there is still limited understanding of the specific factors that shape urban public spaces for sports. In particular, there is a need to explore the physical characteristics of these spaces that either encourage or hinder participation in sports activities. This thesis aims to fill this gap by identifying the factors that influence the design and functionality of urban public spaces in promoting sports participation for all. By highlighting both the barriers and facilitators to sports

participation in outdoor spaces, this research contributes to improving the success of sports city developments. These insights can guide future urban interventions to create inclusive environments that encourage sports and physical activity for everyone.

Second:

Over the past few decades, street running has become one of the most popular sports. City centres are a venue to host a variety of sports and physical activities for everyone [54, 55]. People with disabilities are also increasingly interested in participating in street running [56]. However, the typical design of urban public spaces for able-bodied individuals often fails to accommodate the needs of people with disabilities [38, 39]. Policymakers and urban planners are aware that improperly designed public spaces create barriers for people with disabilities. There has been limited study focus on how these barriers impact disabled runners. This thesis addresses this research gap by exploring the perceived physical barriers in urban public spaces, specifically the spaces in-between buildings that hinder disabled runners. By identifying these barriers, the study seeks to contribute to the current discourse on creating inclusive public spaces that allow people with disabilities to engage in running and other physical activities independently.

third:

Recreational areas such as parks and play spaces provide enjoyment and activity opportunities for everyone. However, individuals with disabilities often face difficulties in accessing and using these environments [33-36], mainly due to design, environmental, and safety barriers that limit their participation. Despite the existence of universal design and accessibility standards aimed at removing physical barriers in revitalising recreation areas, these obstacles have still been available for people with disabilities. Very few studies have investigated accessibility and usability when revitalising recreational spaces for people with disabilities [32]. Furthermore, limited research has been conducted to evaluate these spaces based on universal design and international and national accessibility standards. In light of these issues, this thesis delves into the physical features of outdoor recreational areas that pose challenges for individuals with disabilities seeking to participate independently in recreational and play spaces. Additionally, this thesis evaluates and compares four urban public parks in different countries to identify best practices for revitalization that address these challenges for everyone in outdoor recreational spaces. This thesis also contributes to a more comprehensive understanding of the barriers and facilitators in recreational spaces for people with disabilities, using both qualitative and quantitative methods.

Figure 1 shows the theoretical framework and associated hypotheses supporting this thesis. The framework is based on the 'Sports Cities for All' model, which is designed to create inclusive, accessible, and vibrant environments that encourage physical activity, sports, and recreation for all residents, regardless of age, ability, or socioeconomic status. It illustrates how the planning and design of physical characteristics of outdoor public spaces, considering universal design principles and local and international accessibility standards, can be linked to the participation of people with disabilities in sports.

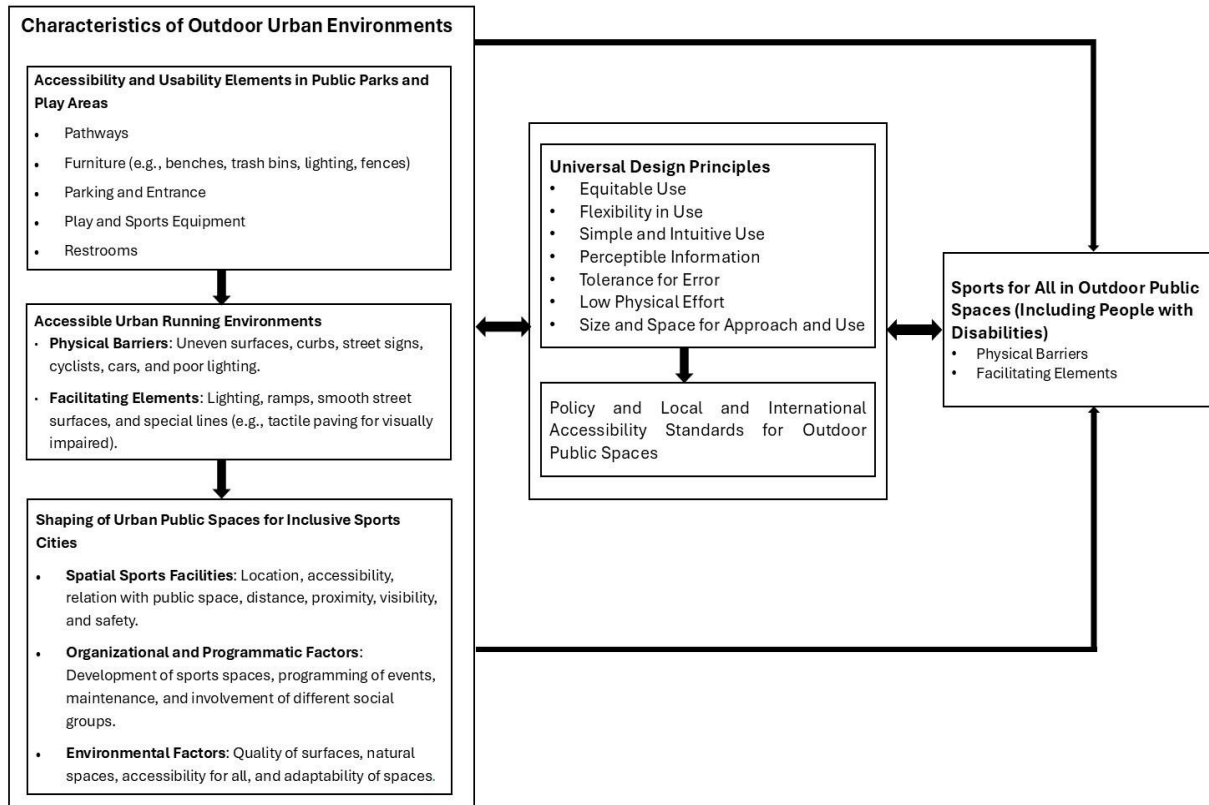


Figure 1. Conceptual framework

This study focuses on concepts that explore the barriers and facilitators to sports participation for everyone, with particular attention to people with disabilities. In this context, the thesis investigates three types of urban areas: outdoor recreation spaces (such as public parks and play areas), urban running environments (in-between buildings), and general urban spaces.

In this thesis, the main things that are looked at to see how they affect urban public spaces in inclusive sports cities are spatial factors related to sports facilities (like where they are located, how accessible they are, how they connect to public spaces, how close they are, how visible they are, and how safe they are), organisational and programmatic factors (like how the

sports spaces were built, how events are planned, how they are maintained, and how many people from different social groups are involved), and environmental factors (like surface quality, natural spaces, how accessible they are to everyone, and how easily spaces can be changed).

Barriers and facilitators categorise the perceived characteristics of accessible urban running environments, particularly those between buildings. Perceived physical barriers include uneven surfaces, curbs, street signs, cyclists, cars, and poor lighting. Facilitating factors include good lighting, ramps, smooth street surfaces, and specialised markings (such as tactile pavers for the visually impaired).

The characteristics observed and assessed to evaluate accessibility and usability in public parks and play areas include pathways, furniture (such as benches, trash bins, lighting, and fences), parking and entrances, play and sports equipment, and restrooms.

The framework assumes that the physical features of outdoor public spaces—especially those that make cities into sports cities, make running environments in cities more accessible, and make public parks and play areas easier to get to and use—are directly connected to both the things that make it challenging and easy for everyone to participate in sports.

Furthermore, we assume a direct connection between universal design and accessibility standards and the promotion of sports for all in outdoor public spaces. Additionally, there are strong direct relationships between the physical characteristics of accessible urban running environments and the accessibility and usability of public parks and play areas. These factors may have a moderate relationship with the design of urban spaces for sports cities, especially for people with disabilities. Both factors strongly interact with each other.

The types of barriers in the framework can be seen in the characteristics of outdoor public spaces that are directly associated with hindering people with disabilities from participating in sports activities. These barriers include the distance of sports facilities and organised sports activities from the residence, feelings of unsafety, the quality of sports facilities, the accessibility of recreational spaces, the accessibility and usability of play areas and equipment, the quality of surface environments, and the accessibility of services and furniture provided in sports areas.

### **1.3 Aim and research questions**

In order to fill in the gaps in existing research, the main aim of this thesis is: To comprehensively explore the critical key factors influencing the physical characteristics of outdoor public spaces in promoting accessible sports for all, in explanation, it focuses on evaluating the accessibility and usability of features of the revitalized outdoor recreational areas across different geographical contexts, based on universal design principles and international and local accessibility standards, thus helping people with disabilities independently participate in outdoor recreational places.

To achieve the main aim, this study developed four research questions. Each question is addressed in a separate chapter of this thesis.

- 1. What factors facilitate or hinder sports participation, and how do they shape urban public spaces to create inclusive, accessible sports cities for everyone?**
- 2. What physical features in urban public spaces create barriers for physically and visually disabled street runners, and how can these barriers be identified and addressed to improve accessibility in the running environment?**
- 3. What specific design interventions and accessibility improvements are needed to optimize the inclusivity of the Activity Zone in Chorzów City, Poland, for individuals with disabilities, based on universal design principles and local standards?**
- 4. What are the differences in accessibility and usability of outdoor play spaces for individuals with disabilities in urban public parks across Hungary, Poland, Iraq, and Saudi Arabia, and how do national policies, awareness, and planning practices impact the design of inclusive play environments in these countries?**

The above research questions address different gaps in this thesis, including synthesis, empirical, geographical, practical application, and policy-comparative gaps.

## **1.4 Research design**

### **1.4.1 Data collection**

This thesis is based on a literature review, case study observations, and cross-sectional studies. Chapter 2 synthesizes the literature to address all groups of people. Chapter 3 focuses on cross-sectional studies of specific target groups (male): disabled runners aged 18-65. Chapters 4 and 5 involve observation, evaluation, and assessment according to universal design principles and local and international accessibility standards, using case studies from various countries to address diverse groups (children, youth, adults, the elderly, and people with disabilities). Data collection was conducted in three different ways.

### **1.4.2 Disabled runners**

Data for Chapter 3 were collected from 150 disabled runners in May 2021 using an online survey. This cross-sectional study focused exclusively on men with disabilities who participated in street running and marathons in 2019, including events such as the Shanghai Marathon, London Marathon, and Boston Marathon. Participants received the survey link via email and social media, along with information about the study's purpose and assurances that the data would be processed anonymously in accordance with the ethical principles of the Declaration of Helsinki and used solely for research purposes. The aim of the study was to identify perceived physical barriers between buildings in the city environment for disabled runners. Participants were asked to indicate and rate these barriers in their running environment. Completing all the questions was not mandatory, and ultimately, 110 disabled runners fully completed the survey. Of these respondents, 56.36% were physically disabled runners, while 43.64% were visually impaired runners.

### **1.4.3 Case studies**

The Activity Zone in Chorzów, Poland, selected as the case study for Chapter 4, was established between 2018 and 2019. It is located in a wooded area that once housed demolished military buildings. The zone is situated between university buildings and residential districts, acting as a connection between the University of Silesia campus and the city (Fig. 1). Designed as a versatile public space for students, university staff, and local residents, the area was created by SLAS Architects [57]. The space integrates various activities and features an unconventional layout with creatively shaped concrete openings that house lower flower beds or small gardens, supporting the growth of shrubs, grasses, herbs, and trees [58]. The zone promotes inclusivity

with a non-segregated play area for children and includes benches, tables, and fitness equipment evenly distributed throughout the space. The design also encourages adults to participate in children’s activities. The Activity Zone has become a popular gathering spot for people of all ages. This study evaluates the elements of the Activity Zone using the seven principles of universal design, with a focus on accessibility and usability. Qualitative analysis includes observations based on photographs and measurements, while quantitative analysis applies Warsaw accessibility standards. The paper assesses elements such as ramps, surfaces, sports facilities, urban furniture, and parking spaces, categorizing them as either appropriate or inappropriate based on their compliance with these standards.

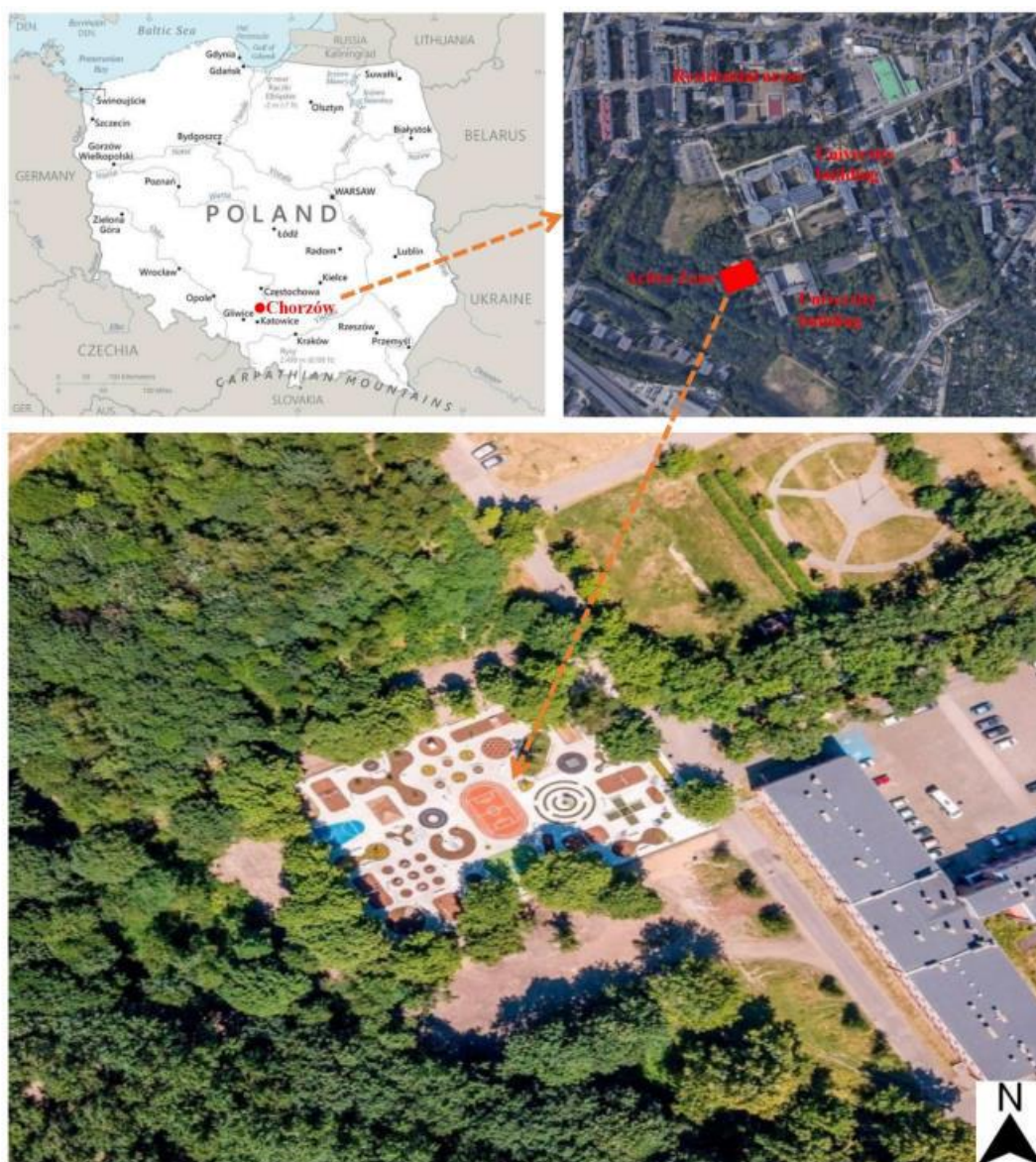


Figure 1: location of the Activity Zone in Chorzów, Poland

In selecting case areas for Chapter 5, the authors intentionally chose four urban public parks of similar size in different countries, ensuring that each park featured play spaces. All of the

selected parks are popular and well-visited recreational areas. Photos of the play spaces were taken using smartphones to visually support the evaluation findings. The final results were based on a retrospective analysis of these photographs. Data collection spanned three months, and the equipment used for the evaluations included pens, paper copies of the PARCS tool, a camera, a smartphone, and measuring tapes.

The PARCS tool, developed based on a literature review, is a validated and reliable evaluation tool specifically designed to assess the accessibility of parks and playgrounds for individuals with disabilities [32]. All accessibility measures were adapted in accordance with the New Zealand Standard guide for buildings and associated facilities [NZS 4121:2001] [59]. The section on play areas was derived from both the U.S. Access Board's Summary of Accessibility Guidelines for Play Areas [61] and the New Zealand Standard guide [NZS 5828:2004] for playground equipment and surfacing [60].

This study utilized the PARCS tool, which had been successfully implemented in a previous study. The development and validation of the tool involved collaboration with CCS Disability Action (a disability advocacy organization in New Zealand), the Blind Foundation of New Zealand, and representatives from three city councils, including town planners, park and recreation managers, and accessibility support groups. Following consultations with these stakeholders and researchers, the tool was reviewed and adjusted to ensure it adequately addressed all aspects of accessibility and usability for people with disabilities [32]. The PARCS tool is divided into two sections: accessible routes, and facilities and amenities. The accessible routes section covers parking spaces and path surfaces, while the facilities and amenities section includes play areas, rest areas, and restrooms.

#### **1.4.4 Secondary data**

Data for Chapter 2 were collected through a systematic review aimed at identifying the factors that influence the design of public spaces in sports cities that are accessible to all. Ten electronic databases were searched to find relevant studies published between 2010 and 2022: WoS, SPORTSDiscus, Google Scholar, Scopus, ScienceDirect, AMED, JSTOR, ERIC, IEEEExplore, and PubMed. The authors focused on the most recent studies to ensure the findings were relevant to current research and practice. A systematic search strategy was developed for each database using three key terms: spatial sports facilities, organizing and programming, and environmental factors. Additionally, the review considered nine sub-terms: sports facilities,

sport, sport for all, public spaces, sports city, regeneration, events, physical activity, and car-free day program.

Bibliographies of relevant studies were examined to identify additional references, and Google Scholar was used for citation tracking. Figure 1 outlines the steps for selecting the publications included in this systematic review. Two reviewers independently assessed and extracted the data. Full-text copies of 68 articles were reviewed, and 24 articles that met the inclusion criteria were included in the final analysis.

## **1.5 Outline**

This thesis explores the key factors influencing the physical characteristics of outdoor public spaces in promoting accessible sports for all; it evaluates the accessibility and usability of features of the revitalised recreational outdoor areas based on universal design principles and local accessibility standards to enhance accessibility for people with disabilities in sports and physical activities. Chapters 2, 3, 4, and 5, each written as individual articles published in peer-reviewed journals, examine different aspects of these themes.

Chapter 2 provides a deeper understanding of the key factors shaping urban public spaces in inclusive sports cities. Location, accessibility, connection to public spaces, distance, proximity, visibility, and safety are some of the spatial factors that affect sports facilities. Other factors include organisational and programmatic aspects, such as the development of sports spaces, event programming, maintenance, and the participation of different social groups. Finally, environmental factors, such as surface quality, natural spaces, universal accessibility, and the ability of spaces to be changed.

Chapter 3 focuses on the significance of perceived barriers in accessible urban running environments, particularly in the spaces between buildings for disabled athletes. Barriers include uneven surfaces, curbs, street signs, cyclists, cars, and poor lighting; facilitating factors include ramps, smooth street surfaces, good lighting, and specialised markings like tactile paving for the visually impaired.

Chapters 4 and 5 explore the revitalization of outdoor recreational spaces for people with disabilities across various countries. These chapters assess the accessibility and usability of public parks and play areas, examining elements such as pathways, furniture (benches, trash bins, lighting, fences), parking and entrances, play and sports equipment, and restrooms, all based on universal design and local and international accessibility standards.

Finally, Chapter 6 presents the conclusions and implications of this PhD thesis, summarising key findings, addressing research questions, identifying research gaps, and offering recommendations for future studies and policies with a focus on universal design and accessibility standards.

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## CHAPTER 2

### WHAT FACTORS INFLUENCE THE SHAPING OF URBAN PUBLIC SPACES FOR SPORTS CITIES? A SYSTEMATIC REVIEW

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## **Abstract**

In recent years, the concept of developing sports cities has gained popularity and become a notable trend. Urban public spaces have played an important role as suitable venues for informal sporting activities in cities. Policymakers and scholars have come to realize that an aesthetically pleasing and well-designed public space can encourage and increase participation in sports. This systematic review aims to identify the factors that influence the shaping of public spaces for sports cities accessible to all. Ten electronic databases were searched to identify relevant studies published between 2010 and 2022. The data were independently assessed and extracted by two reviewers. Full-text copies of 68 articles were read, and 24 articles meeting the inclusion criteria were included in this review. A synthesized descriptive analysis of the data was then performed. The results of this review identified factors that influence the shaping of urban public spaces for sports cities, including spatial sports facilities, organizational and programmatic factors, and environmental factors. Some factors can facilitate sports and physical activity, while others may act as barriers and have a negative impact on participants. This study recommends summarizing the policy and practice implications of these results for promoting sports cities to address these barriers and make sporting activities more accessible to all.

## 2.1 Introduction

Increasing participation in sports is an important goal of health policy [1, 2]. Policymakers are increasingly acknowledging the role of the built environment in creating favourable conditions for active lifestyles. Currently, cities serve as venues for informal sports for all. The idea of “sports city” has gained popularity in recent years as an abstract concept, often used in one of two ways: to designate a specific area within a city as a sports city or to brand an entire city as a sports city [3]. The significance of sports cities is increasingly recognized in social, health, economic, and spatial contexts. Additionally, researchers have emphasized the positive impact of sports on health and well-being and the role of sports in promoting social cohesion [2, 4–6].

In modern urban society, sports have become an integrated part of our lifestyle, and an increasing number of people are engaging in sports regularly. Furthermore, there is a growing trend towards individualized sports, with fewer people participating in team-based activities. Sport is no longer confined to specialized sports complexes on the outskirts of the city, and anonymous sports facilities are becoming less common [7–9, 72]. As well as Municipalities aim to design cities that motivate individuals to engage in higher levels of physical activity [10–12].

The importance of urban public spaces for sports and physical activity has increased, and public spaces are now being utilized as venues for practising and organizing various sporting activities and events, including individual and non-organized sports such as running, biking, and parkour [13–15]. The use of public spaces for sports can also be a powerful tool for creating a more sustainable city [16]. Developed countries are increasingly aware of the importance of sports in urban planning, and government policies are aimed at creating a sustainable city that provides convenient access to outdoor sports facilities for everyone to engage in physical activity [17, 18]. This approach also can promote the creation of active sports cities.

There are several factors for creating sports cities and promoting sports participation in urban public spaces [7, 19]. Many studies have identified some factors that could lead to an increase in sports participation in urban environments, including spatial sports facilities [20–23], environmental factors [9, 24–29], and organization and programming [7, 30–35]. All of these factors play an important role, as they can attract and encourage people to participate in sports. However, they can also act as barriers to participation when organizing sporting events

in the urban environment, which can negatively impact the frequency of participation [23, 29, 32, 33, 36, 37].

In this study, the factors associated with sport participation in urban public spaces were classified using the theoretical framework of the sports city idea. The effectiveness of this idea in categorizing potential factors related to sport participation in such settings has been demonstrated [3, 7, 24, 38, 39]. The sports cities idea suggests that there are several factors at various levels that could influence participation in sports including spatial factors (e.g., location, accessibility, relation with public space, distance and proximity, visibility and opening), organisational and programmatic factors (e.g., program mix, developing sports spaces and facilities, maintenance, and policy and target group), and environmental factors (e.g., quality of sport surfaces, accessibility, natural spaces, adapting and attracting spaces).

Improving our understanding of the factors that encourage or impede sports participation in outdoor spaces may increase the success rate of enhancing sports cities and provide direction for making more sustainable cities. Thus, the aim of this study was to conduct a systematic review because the existing literature had not yet been compiled to identify the factors that facilitate or hinder sports participation in urban public spaces accessible to all. This information is essential for sports organizers, policymakers, and urban planners to lead interventions in urban environments that promote sports participation and facilitate the organization of events for all people.

## **2.2 Methods**

### **2.2.1 Search strategy**

The following ten electronic databases were searched to identify relevant studies published between 2010 and 2022: WoS, SPORTSDiscus, Google Scholar, Scopus, ScienceDirect, AMED, JSTOR, ERIC, IEEEExplore, and PubMed. The authors focus on the most recent studies to ensure that the findings of this paper are relevant to current research and practice. For each database, a systematic search strategy was established using three key terms which are: spatial sports facilities, organizing and programming, and environmental factors. In addition, this review sought for nine sub-terms which are as follows: sports facilities, sport, sport for all, public spaces, sports city, regeneration, events, physical activity, and car-free day program. Bibliographies of relevant studies were identified for additional references and Google Scholar

was used for citation tracking. Figure 1 outlines the steps selected for the publications included in this systematic review.

### 2.2.2 Critical assessment and data extraction

This study ensured that the conclusions were made based on moderate to high-quality research papers. The Critical Appraisal Skills Program checklist [www.caspuk.net] was utilized to achieve a minimal standard (i.e., assessing the papers that only scored 50% or more of the possible points on a revised version). The checklist comprises ten questions which address areas such as clarity of objectives, data collection, analysis, and ethics (Table 1). The first two questions in this review were graded on a two-point scale (yes/no), and the last eight were graded on a three-point scale (yes/cannot tell/no). The highest score was 28.

According to the checklist, those articles below the minimum of 50% were excluded. The Joanna Briggs Institute [40] developed a form that was used to extract data after critical evaluation. The form included information about the study’s design, sample, data collection, analysis, and outcomes [41]. Furthermore, many studies applied a similar form that included information about the study’s design, sample, data collection, analysis, and outcomes [41–43]. Two reviewers independently judged the included and excluded papers. Finally, a discussion between them was made to settle any disagreements.

Table 1. Ten questions for assessing the quality of systematic reviews: Critical Appraisal Skills Program (CASP) checklist [44]

Screening Questions	Responses		
1. Was there a clear statement of the aims of the research?	Yes	Can’t tell	No
2. Is a qualitative methodology appropriate?	Yes	Can’t tell	No
Detailed questions			
3. Was the research design appropriate to address the aims of the research?	Yes	Can’t tell	No
4. Was the recruitment strategy appropriate to the aims of the research?	Yes	Can’t tell	No
5. Was the data collected in a way that addressed the research issue?	Yes	Can’t tell	No
6. Has the relationship between research and participants been adequately considered?	Yes	Can’t tell	No
7. Have ethical issues been taken into consideration?	Yes	Can’t tell	No
8. Was the data analysis sufficiently rigorous?	Yes	Can’t tell	No
9. Is there a clear statement of findings?	Yes	Can’t tell	No
10. How valuable is the research?	Yes	Can’t tell	No

www.casp-uk.net

### **2.2.3 Data synthesis and analysis**

Framework analysis was used for the extracted data. This systematic method summarizes the data into a themed chart. Other studies have used it successfully in synthesizing quantitative and qualitative research [41–43, 45, 46]. Five stages are involved, which are:

- being systematically familiar with the information;
- identification of important themes for creating a thematic framework;
- systematically labelling important issues with an index;
- using the data to create a number of thematic tables and charts;
- and finally, mapping and interpretation.

The first author used Excel to construct graphs and summarize data from all the research. A collaboration was then done with the second author to develop themes.

## **2.3 Results**

2408 publications were produced by the search technique for the electronic databases, but 2340 of them were rejected based on their abstracts or titles. 44 publications were not included in the full-text analysis of the 68 papers that were obtained. Figure 1 shows the references for the articles that were excluded along with the accompanying reasons. Twenty-four studies investigating aspects of shaping a friendly city for sports in urban public space were included in the review, the main characteristics of which are drawn in Table 2. Five studies focused on spatial sports facilities, ten studies on the organizational and programmatic aspects, and nine studies on environmental factors (adapting and attracting spaces).

The quality score for the assessment of the included studies ranged from 21 to 26, out of 28 points. Surveys were carried out on multi-types of sports and events in different countries, however, a few of the studies did not specify the type of sports. Questionnaires, semistructured interviews, focus groups, case studies (GIS and maps, documentation, photographs), observation, and interviews were used to collect data in the included studies. The three factors which shaped this overarching concept covered the main aspects to emerge from the synthesis (Table 2).

### **2.3.1 Aspects of shaping public spaces for sports cities**

All of the included studies identified the characteristics of public spaces which need to exist in order to be able to promote participation in sports for all as well as give an image of sports to cities (Table 2).

### **2.3.2 Spatial sports facilities**

Five included studies identified characteristics of spatial sports facilities which influence the promotion of participation in sports [7, 22, 23, 37, 47]. Some identified characteristics that spatial sports facilities should have and which could aid in encouraging increased participation include locations in cities close to residential areas, accessibility to all, especially the disabled, relationship with public space, visibility and opening, and safety and comfort in sports spaces. However, participants reported that barriers to spatial sports facilities included: inequity in access, unfair distribution in the number of outdoor sports facilities, the spatial pattern of the facilities and socio-spatial neighbourhood features such as safety, socioeconomic status, and density (Table 2).

### **2.3.3 Organizing and programming**

Ten included studies identified those aspects of organizational and programmatic sports in urban public spaces which influence the promotion of participation [7, 23, 28, 30-35, 48]. Factors which promote participation include: developing sports spaces and facilities, provision of secure, safe, comfortable, and well-maintained spaces, organizing sports activities near or/in natural spaces, involvement of different social groups in the organizing process, creating policies which target different social groups, and having programs which mix multiple sporting activities at different times.

However, reported barriers to participation in organized sports include: ticketed events that become a place for marketing and revenue generation, distances between homes and sporting venues, and the duration and time of organizing sports. Several actors and organizations can act as barriers to informal participation in organized sports, thereby leading to a reduction of participants. Also, by engaging informal people in sports activities, the possible location becomes more contrasted, disconnected, and socially excluded (Table 2).

### **2.3.4. Environmental factors**

Nine included studies identified the environment as a factor in attracting and encouraging sports participation in outdoor urban spaces [9, 23–29, 49]. Ways in which environmental factors encourage participation include provision of accessibility for everyone, proximity to places of residence, an interesting and aesthetic design of the place, large numbers of sports facilities and higher proportions of green and blue spaces. Others are feelings of safety, comfortable environmental surface areas, regular maintenance of public spaces and facilities;

variability and multifunctionality in sports and recreational spaces, and adjustment to possible changes. On the other hand, difficulties encountered in enticing people to participate in outdoor sports include lack of accessibility for all people, a variety of safety issues, exclusiveness for some groups of people, no room for a temporary change of uses (users or activities); the most frequent barriers are poor lighting, unleashed dogs, cyclists, and cars (Table 2).

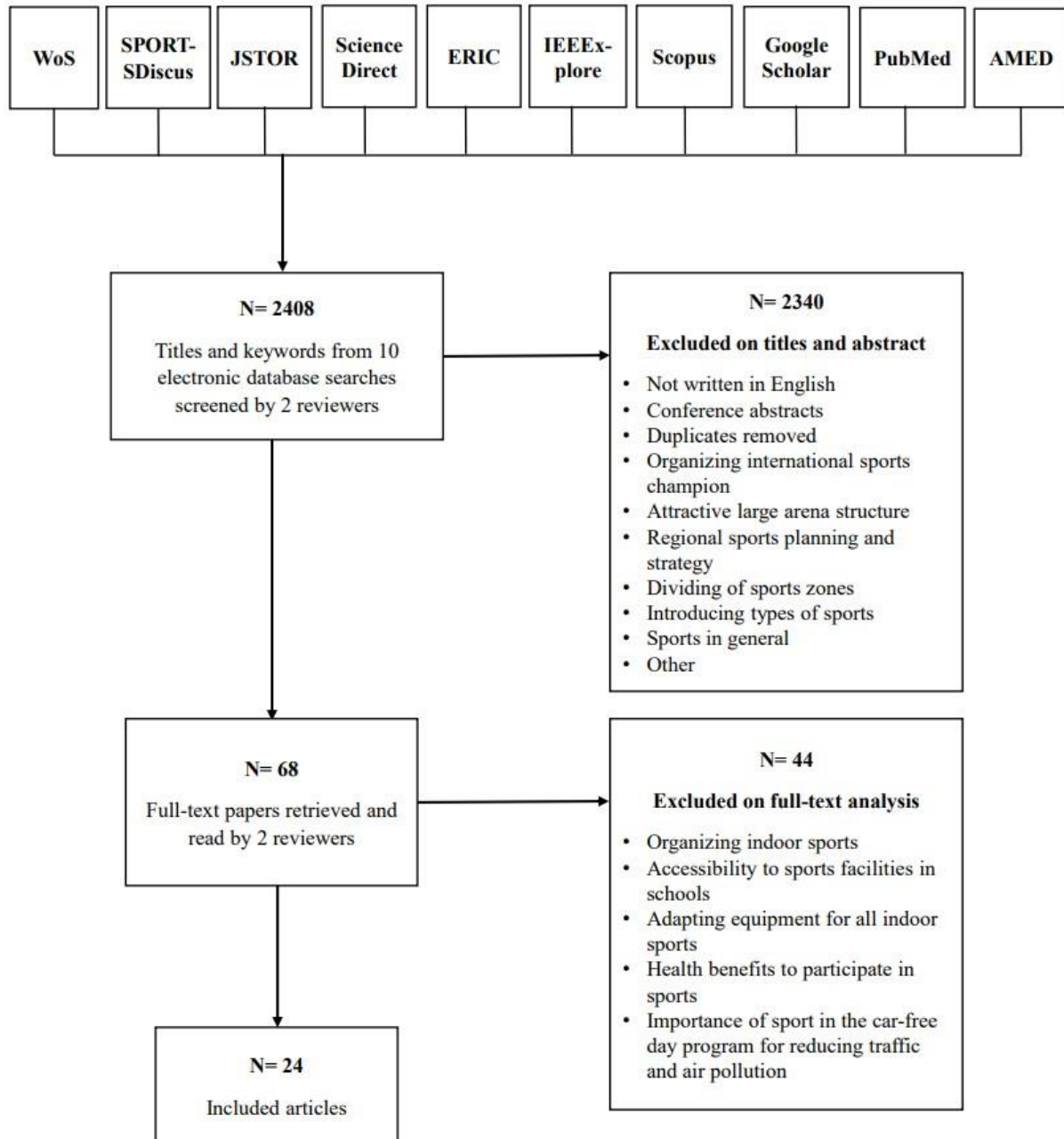


Figure 1. The study selection process excluded articles at each stage

## 2.4 Discussion

In this study, we investigated factors which influence ideas on shaping public spaces for sports cities, for the promotion of sports participation in urban environments. This systematic

review centred on three aspects that may be considered in urban public spaces for increased participation in sporting activities. They include spatial sports facilities, organization and programming, and environmental factors. In general, the findings of the characteristics of each aspect were identified in the included studies, which impacted the creation of attractive environments for the organization of informal sports for all in urban environments.

The findings of our study underscore the importance of spatial sports facilities in the development of active sports cities and in promoting greater participation in sports. By increasing the number of sports facilities and ensuring their proximity to residential areas, we can encourage more people to engage in sports and physical activities. This is especially important for diverse groups of individuals, including those with disabilities and the elderly, as easy access and safety for sports facilities make them more attractive.

However, our study also highlights the negative impact of distance, inequitable access, and uneven distribution of outdoor sports facilities in neighbourhoods, which can discourage sports participation. Previous research has also demonstrated similar results that sports facilities play a crucial role in promoting physical activity and increasing activity levels by providing easy accessibility [4, 18, 50–52], with the number of facilities located near participants' residences being a key factor [53–55].

Therefore, efforts to increase sports participation should focus on enhancing access to relevant facilities [56]. Our results suggest that integrating sports facilities into other functions in urban environments, particularly public spaces, can help address barriers that sports participants face. Additionally, sports facilities can serve as social meeting places, contributing to the image of sports cities that are welcoming to all.

In order to create lively outdoor urban environments through sporting events, it is essential to organize and program multi-sport activities which can target all groups of people at different times [7]. Our results showed that different people from various backgrounds voluntarily taking part and collaborating with multiple agencies and informal groups in organizing sports can increase the range of participation in sports. Similar studies have found that ensuring participation of different social groups in the organization of sports can support the creation of strong social relationships between participants which can in turn increase the frequency of participation in sports [57–60, 73, 35], however noted that several organizers and actors act as invaders and barriers to informal participants partaking in organized sports, the result of which is conflict in sporting events and combative relationships.

Table 2 Summary of articles reviewed based on promoting sports in urban public spaces

Aspects	Sources	Aims	Data collection and methods	Types of sporting events	Characteristics findings	Quality score out of 28
<b>Spatial sports facilities</b>	Valle et al., 2013	To comprehend the spatial relationship between the sports facility and its direct surroundings, as well as how sports spaces can be integrated into physical urban settings.	Site visits, focus groups, and interviews	Basketball, gymnastics, skateboarding, and football	<ul style="list-style-type: none"> <li>• Location in the city</li> <li>• Public access and lockability</li> <li>• Accessibility</li> <li>• Distance and proximity</li> <li>• Relationship with public space</li> <li>• Sports size and typology</li> <li>• Visibility and opening</li> </ul>	25
	Deelen et al., 2016	To what extent do spatial circumstances affect restrictions on sports participants?	Questionnaires	Tennis and swimming	<ul style="list-style-type: none"> <li>• Accessibility and distance to sports facilities</li> <li>• Socio-spatial area features (ex., safety, density, and socio-economic status)</li> </ul>	26
	Kostrzewska, 2017	To find the urban and architectural characteristics of public places in modern cities that can increase sports and physical activity.	Case studies and observation	Skateboarding, DIY sports and	<ul style="list-style-type: none"> <li>• Proximity to residential areas</li> <li>• Accessibility to all, including the disabled</li> </ul>	24
	Dharmawan et al., 2018	Determine the factors that play a role in the community's levels of sport participation.	Observation, interview, and documentation studies	Football, Volleyball, Walking, cycling and roller skating	<ul style="list-style-type: none"> <li>• Accessibility</li> <li>• Safety</li> <li>• Comfortability in sports spaces</li> <li>• Health and fitness</li> </ul>	21
	Asefi et al., 2020	To evaluate the effects of planning outdoor sports facilities on sports activities in neighborhoods.	GIS and documentation (maps)	N/A	<ul style="list-style-type: none"> <li>• Inequity in access to outdoor sports facilities</li> <li>• Population density</li> <li>• Spatial pattern of the facilities</li> <li>• Number of outdoor sports facilities</li> </ul>	22

**Organizing and programming**

Vermeulen, 2011	Analysis of organized sports activities that young people engage in on public playgrounds.	Observation and interviews	Public playgrounds	<ul style="list-style-type: none"> <li>• unfair distribution of outdoor sports facilities</li> <li>• Become a place of contrast</li> <li>• Alternate orderings</li> <li>• Become a place of disconnection and social exclusion</li> <li>• Participants function as a heterotopia</li> </ul>	24
Valle et al., 2013	To comprehend the programming and organizing relationship between the sports facility and its direct surroundings, as well as how sports spaces can be integrated into physical urban settings.	Site visits, focus groups, and interviews	Basketball, gymnastics, skateboarding, and football	<ul style="list-style-type: none"> <li>• Developing sports spaces and facilities</li> <li>• Maintenance</li> <li>• Program mix and sports chains</li> <li>• Multiple uses</li> <li>• Policy and target group</li> </ul>	25
Spaaij et al., 2014	To debate the multidimensional process of cultivating a safe space for community events and sports management leverage.	Case studies	N/A	<ul style="list-style-type: none"> <li>• Physical: accommodating environment, accessibility, provision of security and safety from physical harm</li> <li>• psychological/affective: protection from emotional and psychological harm</li> <li>• Sociocultural: acceptance, recognition, and familiarity</li> <li>• Political: respect for differences, collaborative learning, and dialogue</li> <li>• Experimental: experimentation encouraged to happen within the context of a sports event and risk-taking</li> </ul>	23
Smith, 2017	Explain the growing pressure to use public places for a greater range of events and the repercussions.	Analysis case studies	elite sports events, music festivals, and trade exhibitions	<ul style="list-style-type: none"> <li>• Ticketed events</li> <li>• Restricted access to parks</li> <li>• Securitization, commercialization and privatization processes that disturb public spaces</li> </ul>	25

Kostrzewska, 2017	Find the urban and architectural characteristics of public places in modern cities that can increase sports and physical activity.	Case studies and observation	Skating, sports and aerobatics	DIY and	<ul style="list-style-type: none"> <li>• Become a place for marketing and revenue generation</li> <li>• Taking into account the diverse needs of different social groups</li> <li>• Ensuring the participation of different social groups in the design and organizing process</li> </ul>	25
Deelen et al., 2018	To examine how use of time and attributes of the physical setting influence adolescents to dropout from sports.	Questionnaires	Football and tennis		<ul style="list-style-type: none"> <li>• The distances between home and the sporting venues</li> <li>• Participation in two sports at the same time</li> </ul>	25
Chacón - Borrego et al., 2018	To examine features of organizing leisure activities and sports and how it relates to determining the utilization of urban public spaces for activities.	Questionnaires	Football, Skateboarding		<ul style="list-style-type: none"> <li>• Organizing high-frequency same sports</li> <li>• Duration, regularity and at any time</li> <li>• Sociodemographic variables such as age and sex determine the use of public space</li> </ul>	21
Jeanes et al., 2019	Investigate how informal participation fits into the framework of a policy that aims to increase sports participation.	Semi-structured interviews with stakeholders	N/A		<ul style="list-style-type: none"> <li>• Currently, rather than encouraging the growth, increase and thriving of informal participation in sports, several actors and organizations act as barriers to it.</li> </ul>	23
Proklama latu et al., 2021	To investigate the physical and sociological perspectives of urban residents on the use of streets as open spaces in the Car-free Day Program.	Questionnaires and observation	Football, Volleyball, Walking, cycling and roller skating		<ul style="list-style-type: none"> <li>• Taking into account the comfort spaces</li> <li>• Maintenance</li> <li>• Active engagement support</li> <li>• Providing safety and clean air spaces by removing cars</li> </ul>	22
Smith et al., 2021	Explore how to decrease problematic issues and user conflicts which relate to using public spaces as staging areas for events	Analyses of case studies	Events		<ul style="list-style-type: none"> <li>• Practical sense is required when trying to adapt public spaces into more suitable, well-prepared venues.</li> </ul>	23

<b>Environmental factors (adapting and attracting spaces)</b>	Borgers et al., 2016	To determine what facilities for light sports can help achieve the objectives of attracting new or "light" sports participants.	Interviews with runners	Running	<ul style="list-style-type: none"> <li>• Accessibility of facilities</li> <li>• Comfortable running surfaces</li> <li>• Existing facilities (light, trees, safety, etc.)</li> <li>• Proximity to living places, other sporting venues, and sanitary facilities.</li> <li>• Provision and maintenance of public facilities</li> </ul>	26
	Ettema, 2016	Investigate how attributes of running areas and frequency of running relate to the perceived attractiveness or annoyance of the environment.	Questionnaires	Running	<ul style="list-style-type: none"> <li>• Running in parks and the quality of running surfaces are both positively connected with attractiveness</li> <li>• The most frequent irritants are poor lighting, unleashed dogs, cyclists, and cars</li> </ul>	26
	Priyono et al., 2017	Explain the adaptation patterns of sports participants' utilization of public spaces.	Documentation, observation, and interviews.	Gymnastic community performances, aerobics, and exercises	<ul style="list-style-type: none"> <li>• Adjustability to possible changes</li> <li>• Accessibility by all people</li> <li>• Sociocultural factors (social, ecologic, physical, and economic)</li> </ul>	22
	Kostrzewska, 2017	Find the urban and architectural characteristics of public places in modern cities which can increase sports and physical activity.	Case studies and observation	Skating, DIY sports and aerobic	<ul style="list-style-type: none"> <li>• Variability and multifunctionality in sports and recreation spaces</li> <li>• Adaptation of open spaces over time to meet the changing requirements of the community</li> <li>• Aesthetics and interesting designs</li> <li>• Proximity to places of residence</li> <li>• Accessibility for everyone</li> </ul>	25

Deelen et al., 2017	Determine whether socio-spatial neighbourhood characteristics and objective physical characteristics are associated with sports participation and location preferences.	Questionnaires	N/A	<ul style="list-style-type: none"> <li>The number of sports facilities and the increased percentages of green and blue spaces are strongly related to sports participation in public spaces</li> </ul>	25
Middle et al., 2017	To find planning guidelines and procedures for parks that might best provide space for a given organized sport.	Case study and documentation (map)	N/A	<ul style="list-style-type: none"> <li>Natural spaces are essential to creating locations that appeal to various recreational users and to the growing number of people who participate in organized sports</li> </ul>	24
Deelen et al., 2018	To identify the motives and goals of sports participants in public spaces.	Questionnaires	Running	<ul style="list-style-type: none"> <li>Green areas</li> <li>Lively running environment</li> <li>Comfortable running surfaces</li> <li>Feelings of safety</li> </ul>	26
Landman, 2020	To explore or rethink inclusive public space for different groups of society and activities.	Case studies	Various physical activities	<ul style="list-style-type: none"> <li>Absence of a temporary change of use (users or activities).</li> <li>Interventions need to adapt to various activities</li> <li>Exclusivity to some groups of people</li> <li>Variety of safety issues</li> </ul>	25
Cognigni et al., 2020	to examine the most recent changes to approaches in public space planning and design in connection to sports activities.	documentation (photographs) and case studies	basketball, skate cycling, football, roller skating	<ul style="list-style-type: none"> <li>Promote new ways of using which can improve current spaces for sport</li> <li>Construction of structures that redevelop deteriorated areas</li> <li>Integration with the context</li> </ul>	25

These can in turn negatively affect participation instead of encouraging it to thrive and grow. Regarding these issues, it might be necessary to permit community groups to plan some of these events [60]. Nevertheless, our results also found that when only young people engage in organized sports activities, contrasts and alternate orderings are created and the places function as a heterotopia rather than a place of connection and social inclusion. Therefore, it is crucial to collaborate with stakeholders to organize and program sporting events for everyone.

For this reason, urban public spaces can bring diverse groups of people together, as well as foster positive emotions and facilitate various activities for all [59, 61, 62, 71, 74]. In relation to this, this review also finds that public spaces can serve as a venue for organized and non-organized sports, as well as for enabling the programming of a wide range of sporting events proximate to residential areas, thereby creating more opportunities for all city residents and leading to higher participation in sports. However, further findings in this study indicate that in the organization of sporting events, sports organizers and practitioners use public places for marketing and revenue generation, which has negatively impacted sports participants [32, 63]. Additionally, a similar study found that management and maintenance issues are frequently overlooked in the design of public open spaces [36]; as a result, our results also show that collaboration between local governments and private parties is critical.

The quality of the urban environment highly influences outdoor sports. Attractive outdoor spaces could increase the frequency of participation in sports [64]. Our results demonstrate that natural spaces are essential for creating locations that appeal to various recreational users and the growing number of people engaging in sports and physical activities. Specifically, higher proportions of green and blue spaces (water spaces and features) affect participants' perception of the spaces' attractiveness. Additionally, the environmental quality of sporting venues, such as comfortable environmental surfaces, feelings of safety, and living environments, can encourage participation in sports. However, our results, especially for running environments, have found that poor lighting, cars, cyclists, and unleashed dogs negatively affect running frequency in urban environments. Furthermore, previous research has concluded that the lack of accessibility for all people and a variety of safety issues are the challenges encountered in enticing people to participate in outdoor sports [34, 65, 70]; therefore, having access to sports facilities can play a significant role in increasing physical activity levels, making it an important environmental factor to consider [18].

According to our results, the urban and architectural characteristics of public spaces in modern cities, such as aesthetics and interesting design, as well as accessibility for all age groups and

disabled people, can entice people of all ages to participate in sports and physical activities. Several previous studies have shown that municipalities are aiming to create cities that promote physical activity among residents [10, 12, 54]. It is important to consider how individuals perceive the physical environment because perceptions of safety and attractiveness can significantly impact sports participation [66]. This may provide a positive sports image and increase visitors' desire to return to recurring events [67]. In addition, participation could also be promoted through, not only increasing the number of sports facilities but by placing them in close proximity to places of residence. And also this review further finds that inclusivity and multifunctionality are important factors in the planning and designing of urban regeneration programs. Regarding the quality of places for accommodating various sports activities, they should be more inviting, friendly, and lively. Besides, some practical sense must be applied when it comes to adapting public spaces into more accessible places for all, where various safety issues are mitigated [25, 34, 66, 68]. Doing this may encourage everyone to take part in sports.

Understanding the factors that shape public spaces for sports in cities and promote sports participation is important for leading interventions in urban public spaces. This review paper clarifies the characteristics that positively and negatively impact sports in an urban environment. By understanding barriers to participation in outdoor sports, we can adjust and enhance them. However, it is even more significant for this study to identify the positive features of sports environments that increase participation.

## **2.5 Strengths, limitations, and further research of this study**

A strength of this study is that it used a comprehensive search strategy to find 24 papers that met the prerequisites for eligibility. The findings were broadly consistent throughout the studies, despite the fact that the main objective was to determine how the urban environment could encourage everyone to participate in sports. English-language publications were included, though being that the English language is one of the reviewer's limitations, it's probable that some relevant literature was overlooked. A thorough search of a few electronic resources was carried out. Published materials which easily identify the research criteria were included. In addition, only researches related to sporting events in public spaces were included.

The objective of this study was to identify the critical aspects that impact the creation of sports cities, based on research areas and insights from professionals in the fields of architecture and urban design. However, gaining a comprehensive understanding of other crucial aspects such as intrapersonal characteristics, sociological and psychological factors, sports disciplines,

cultural differences, and local climate requires further exploration. Conducting a systematic review that deeply examines each aspect will help us improve our understanding of how these factors influence the shaping of urban public spaces for sports cities, benefiting all members of the community.

## 2.6 Practical implications

In order to create sports cities accessible to all, it is imperative that public authorities, practitioners, and urban planners collaborate and prioritize the following factors when revitalizing urban environments. By doing so, they can effectively address the existing barriers that hinder the organization and practice of sports activities in urban public spaces. This collaborative effort will lead to the creation of more accessible and inviting public spaces that can host and organize a diverse range of sporting events, ultimately leading to increased participation in physical activity for individuals of all ages and abilities.

- **Spatial sports facilities factors:** New design and policies required for the integration of physical aspects of sports facilities by customizing sports as an urban meeting place, to decrease or obviate inequity distribution and accessibility to outdoor sports facilities, as well as to increase sports inclusivity should be acknowledged the concept of sport for all that can address the barriers and needs in sports and recreation spaces [7, 23, 37].
- **Organizational and programmatic factors:** Changes in culture and practices within sports development systems, especially in urban public spaces, can be sources of varied forms of programs and attractions for sports and physical activity, to make it easier to accommodate sports activities. It requires ensuring the participation of different social groups in the design and organizing process and contributing to stakeholders' perceptions of rising opportunities to provide a safe space for all through organizing sports and events. It requires avoiding ticketed events and organizing the space for marketing and revenue generation [7, 30–32, 35, 36, 67, 69].
- **Environmental factors:** In the redesigning of public spaces, the focus should be on improving the diversity, usability, and functionality of contact with natural areas (green and blue spaces); this is key to attracting recreational users and increasing participation in sporting events. Also, programs and strategies should be determined which revitalize public spaces, enable more flexibility toward open sports spaces and enhance access where all people can conduct their various activities [23, 26, 29, 34, 64].

## 2.7 Conclusion

There is an increasing trend of developing cities that are specifically designed to host sports and sporting events. Urban public spaces are considered important as suitable locations for informal sports activities. Policymakers and scholars have recognized the potential of aesthetically pleasing and well-designed public spaces to encourage more people to participate in sports. This systematic review found the factors that facilitate or hinder sports participation in urban public spaces. These factors can create sports cities as well as promote sports participation in urban environments, including spatial sports facilities factors (e.g., location, accessibility, relation with public space, distance and proximity, visibility and opening), organisational and programmatic factors (e.g., program mix, developing sports spaces and facilities, maintenance, and policy and target group), and environmental factors (e.g., quality of sport surfaces, accessibility, natural spaces, adapting and attracting spaces). While some features of public spaces can facilitate sports and physical activity, other features may act as barriers and negatively impact participants. To address these barriers and make sporting events more accessible to all, the review recommended policy and practice changes for each aspect.

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## **CHAPTER 3**

### **INTRODUCING THE PHYSICAL BARRIERS IN THE CITY IN-BETWEEN BUILDINGS FOR DISABLED RUNNERS**

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## **Abstract**

Mass street running has become one of the most popular sports that has taken place in the city's center for many years. The interest in the participation of people with disabilities in street running has increased. Policymakers and urban planners are also aware that improperly designed public spaces create a physical barrier for disabled people to participating in street running independently. However, very limited research exists to introduce physical barriers in public spaces for disabled runners. The aim of this research was to introduce perceived physical barriers in the city in-between buildings for disabled runners. The data were randomly collected through an online survey of 110 disabled street runners. Chi-square analysis was carried out to find the results of perceived physical street elements and the avoidance of the running environment's surfaces that become barriers for disabled runners. The t-Test was conducted to explore differences between physically disabled and visually impaired runners in their perception of the barriers of the running environment. This study concluded the perceived types of street surfaces that should be avoided in running environments and perceived barriers in-between buildings that have a negative impact on the organization of running for disabled runners. However, the perceived attributes in-between buildings positively influence running organizations and encourage participation of physically disabled and visually impaired runners in the running environment. Urban practitioners should prioritize revitalizing in-between buildings through developing accessibility to remove all the impediments that may encourage and promote more disabled people to participate in street running.

### 3.1 Introduction

According to the World Health Organization (WHO), about 15 percent of people with different types of disabilities live in the world. They further point to the fact that this figure is growing and is expected to continue in the next several years, as well as having inferior outcomes in health [WHO, 2011b]. Many studies have shown that sufficient information exists for people with disabilities and non-disabled people who participate in sports and physical activities to improve their health [Lamprecht & Stamm, 2006; Kerins, 2005; Edwards & Tsouros, 2008; WHO, 2011a; Kostrzewska, 2017; Smith et al., 2018; Smith & Sparkes, 2019], especially in running [Bodin & Hartig, 2003; Vaandrager, 2007]. Over the past few decades, mass street running has become one of the most popular sports for everyone that has taken place in public spaces [Burfoot, 2007; Scheerder et al., 2015; Ettema, 2016; Deelen et al., 2019]. A growing interest in wheelchair racing among athletes with disabilities has emerged, which has become vital to identifying areas where more research is required [Cooper, 1990]. Nowadays, public spaces in cities are welcomed by organizing different events [Ujma-Wąsowicz, 2012; Smith, 2015], as well as by Carmona and Gehl asserting that public spaces should be accessible to everyone [Carmona, 2010; Gehl, 2010; Ujma-Wąsowicz et al., 2021].

Running in public places has grown in popularity, particularly on public roads [Cooper, 1990; Tiessen-Raaphorst, 2016; Deelen et al., 2019]. However, public spaces have been designed for someone who is healthy and strong [Xiang et al., 2006; Giles-Corti et al., 2019]. Moreover, Francis stated that existing physical barriers in public spaces create insufficient accessibility for people with disabilities, making it difficult for them to move around in the built environment [Francis, 2018], preventing them from participating in sports, physical activity, and social activities daily [Sholihah, 2001; DePauw & Gavron, 2005; Scelza et al., 2005; Allender et al., 2006; Howie et al., 2012; Shields et al., 2012; Yiing et al., 2013; Hargie et al., 2015; Matthews et al., 2015; Wadey & Day, 2018; Richardson et al., 2017; Diaz et al., 2019]. Studies have revealed that the built environment is necessary to integrate design for people with disabilities, leading them to participate in activities of social life [Belir & Onder, 2013; Salha et al., 2020; Badawy et al., 2020]. Regarding those issues, this study focuses on the physical attributes on the built environment that become a hinderance to disabled people in running environment.

To improve the quality of life for disabled people in the United States, the Americans with Disabilities Act has developed the removal of physical barriers in the built environment through accessible and inclusive design [Ujma-Wąsowicz, 2011; Hums et al., 2016], which positively

affects disabled people's ability to live independently and participate fully in all aspects of life [United Nations- CRPD, 2006], and can promote the participation of people with disabilities in sports and physical activity as well as increase the number of opportunities for outdoor sports [Fields in Trust-London, 2008; Ujma-Wąsowicz & Musioł, 2008; Swain et al., 2013; Mahmoudi & Mazloomi, 2014; Bundon & Hurd Clarke, 2015; Kostrzewska, 2017; Kiuppis, 2018; DESA, 2019; Szaszak & Kecskes, 2020; Huang et al., 2020]. In this regard, a study published in *Building for Equality for Disability in the Built Environment* focused on aspects of inclusive streetscapes that require the removal of features [Women and Equalities Committee, 2018] and bad-condition surfaces [Toole et al., 1999]. In urban public spaces, various pavement surface materials, such as cobblestone, concrete, asphalt, blocks, and bricks, have been used and the decision about them depends on the functional requirements [Beuving & Michaut, 2005]. The surfaces that cause barriers reduce the movement of people with disabilities, especially on wet roads for wheelchair street runners [Gleeson, 2001; Martin, 2002; Bromley, et al., 2007]. Jonas asserted that running on the surface forces the runner's body to [Jared, 2018]. In order to avoid causing a trip hazard and easily moving in public spaces, in particular for visually impaired people, the Department of the Environment, Transport and the Regions (DETR) concluded that connected streets and the material used for the surface should be level with the surrounding footpath and have good position of street amenities as well as having good quality conditions [DETR, 1998; Rimmer, 2006; Sport England, 2010; Kesik et al., 2012; Martin, 2013; Borgers, et al., 2016].

According to Peters, who studied transport in Japan to create a barrier-free environment, including no-step, curb cuts, and slopes in Japanese cities, for wheelchair users and visually impaired people [Peters, 2001; Stevens, 2007]. Moreover, several studies observed poorly designed and poor-quality paving materials are obstructions for people with disabilities [Meyers et al., 2002; Rimmer et al., 2005; Kirchner et al., 2008; Martin, 2013; Mohammed, 2016]. In this study, we concentrate on the physical attributes of the running environment that become the barriers for disabled runners in street running. Those environmental factors are positively related to sports participation, including access to sports facilities, street connectivity, and street design can be more usable for people with disabilities, but it may be difficult with decayed pavement materials and the poor condition of the streets [Kamphuis et al., 2008; Hoekman et al., 2017; Deelen et al., 2017; Hussein, 2018; Ismael et al., 2019]. Concerning the physical environment and various surfaces, Allen Collinson observed that smooth paving can be a more attractive environment for running. However, slopes, holes, muddy paths, and uneven pavements may make a difficult and less attractive environment for running and the chance of harm and injury may

increase. Furthermore, the risk of injury and harm to runners is increased by poor street lighting and different types of transport, particularly cars. However, the quality of the running environment needs to be improved to avoid injuries to runners [Hockey & Allen-Collinson, 2006; Collinson, 2008; Bashiti & Rahim, 2016].

It is important that barriers and objects should be avoided in public spaces, leading to them being accessible with provisions for independent movement for all people [Shahraki, 2021]. The studies also found that cars, cyclists, and poor lighting on running streets are the most frequently experienced barriers in the built environment by able-bodied street runners. However, without cars, the running frequency on paved streets has increased [Ettema, 2016; Deelen et al., 2019]. The objective of municipalities is to design cities by changing and improving the built environment to increase the attractiveness of urban running environments in order to motivate people to keep running and to become more physically active [Breuer et al., 2011; Borgers et al., 2016; Gadais et al., 2018]. Regarding that, Clematis Street in America implemented the process of revitalization to achieve universally accessible streets that are adaptable for special events [Robert, 2020]. It may promote of running environments for all [Titze et al., 2005].

Policymakers and urban planners are increasingly recognizing that public spaces may play an essential role in promoting active living for people with disabilities. Many studies have revealed evidence for the importance of objective physical environmental features on sports participation and physical activity. Fewer studies have been conducted to investigate how physical environmental attributes impact on disabled runners in the running environment as impediments [Cooper, 1990; Priyono et al., 2017]. Physical barriers are currently present in most urban public spaces, making it difficult for disabled street runners to independently participate in mass street running, despite an increased interest in disabled runners participating in running. However, very limited research exists about what particular physical attributes in public spaces make a barrier for physically and visually disabled street runners in the running environment, to address this research gap. The aim of this research was to introduce perceived physical barriers in the city in-between buildings for disabled runners.

## **3.2 Materials and Methods**

### **3.2.1 Participants and Study Design**

Data were collected from 150 disabled runners in May 2021, by using an online survey platform (Pollfish® tools). This cross-sectional study involved and considered only those men with disabilities who participated in street running and marathons in 2019, including the Shanghai

Marathon, London Marathon, and Boston Marathon. They received the survey questions with a web link via email and social media, providing information about the purpose of the study and assurance that the data is anonymously processed according to the ethical principles of the declaration of Helsinki and used for research purposes only. The purpose of this study was to introduce perceived physical barriers in the city in-between buildings for disabled runners and asked the participants to indicate and rate the physical barriers in the running environment. It was not necessary to complete all the questions and, finally, the questionnaire was completed in full by 110 disabled runners, including 56.36% of the respondents were physically disabled runners and 43.64% were visually impaired runners.

### **3.2.2 Measures and Questionnaire**

For the particular aim of this research, the online questionnaire included 13 questions characterizing socio-demographics, the impotence of street surfaces and avoided surfaces, street elements that positively and negatively influence the organization of running and rated physical street elements that become barriers for disabled runners in the running environment. Analyzing socio-demographics included gender, age, country, and education control in this study. The following issues are related to these questions:

The first question was about the type of street surface important for a runner. That was measured with three items included (yes, no, and unsure). The second question asked the respondents to select which surface should be avoided and it was measured with five items included (uneven, various heights, cobblestones, concrete, and asphalt surfaces). The third question asked respondents to identify one of seven permanent street elements that positively influence the organization of the running environment (lighting, ramps, trees and green areas, flat surfaces, special lines, interesting architecture, and street connectivity). Furthermore, the negative impact on the organization of the running environment was measured using six items (curbs, street signs, lighting, various high streets, street turn, and elements (bins, benches, phone boxes, hydrants, bollards, manholes, and so on). The fourth question asked respondents to rate the perception of physical street elements that become barriers for physically disabled and visually impaired runners in street running (curbs, cars, cyclists, street signs, trees and green areas, benches, lighting, and trash receptacles) on a 5-point Likert-type scale ranging from one strongly disagree to five strongly agree.

- Is the type of surface on the street important for a runner?  Yes  No  Unsure

- What surface should be avoided in the running environment?  Uneven  Various heights  Cobblestones  Concrete  Asphalt
- Indicate specific, permanent street elements that positively influence the organization of the running environment for disabled runners.  lighting  Ramps  Tress & green areas  Flat surfaces  Special lines  Interesting architecture  Street connectivity
- Indicate specific, permanent street elements that negatively influence the organization of the running environment for disabled runners.  Curbs  Street signs  lighting  Various high surfaces  Street turn  elements
- How would you rate the following terms as barriers for disabled runners in the running environment?

Variables	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly disagree
Curbs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cyclists	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cars	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Street signs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Benches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
lighting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tress & green areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trash receptacles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### 3.2.3 Data Analyses

IBM SPSS Statistics 26.0 was used to analyze the data. Analyses using chi-square were performed to test the differences between physically disabled and visually impaired runners' perception of the importance of running on environmental surfaces. Respondents' perception of the permanent street elements that positively and negatively influence the organization of running and avoidance of the running environment's surfaces was analyzed using frequency statistics. A one-sample t-test was conducted to explore differences between physically disabled runners and visually impaired runners in the perception of the barriers (curbs, cyclists, cars, street signs,

benches, lighting, trees and green areas, and trash receptacles) of the running environment. An alpha level of .05 was used.

### 3.3 Results

#### 3.3.1. Descriptive Results and Differences between Physically and Visually Disabled Runners

Of the total respondents, 56.36% were physical disability runners and 43.64% were visually impaired runners (Table 1). Most respondents were between 25 - 34 years old (30.65% of physical disability and 45.83% of visually impaired runners) and the minority of them were between 16 - 17 and >54 years old.

18.72% had a lower or middle level of education compared to a higher 81.26%. Respondents were from a variety of continents, including Europe + GB, North and South America, Africa, and Asia.

89.09% of disability runners agree that the type of street surface is important for runners. Uneven and potholed surfaces were chosen by 32.72% of the runners, and various high surfaces were chosen by 29.99% of the runners. Lighting and flat surfaces (20.0% and 10.0%, respectively) were positive, but curbs, street signs, and various high surfaces (17.27%, 7.27%, and 8.18%, respectively) had a negative impact on the organization of the run for visually impaired runners.

Lighting, flat surfaces, and interesting architecture (15.45%, 17.27%, and 7.27%, respectively) were positive, but curbs, elements (bins, hydrants, bollards, phone boxes, etc.), and various high surfaces (14.54%, 9.09%, and 17.27%, respectively) had a negative impact on the organization of the run for physical disability runners.

In the running environment, the average of curbs, street signs, and cars is perceived to be a greater barrier than cyclists, lighting, trees and green areas, and bins for both physically disabled and visually impaired runners. Finally, runners more frequently perceive that the features of the running environment, such as high surfaces, uneven surfaces, curbs, and cars, create barriers for both physically and visually disabled runners from participating in street running.

Table 1. Descriptive statistics of respondents with physical disabilities and visually impaired runners

	Physical disabled runners (N= 62; 56.36%)	Visually impaired runners (N= 48; 43.64%)	Total (N=110) %
Age (%)			
16 – 17 year	4.84	0.00	2.73

18 – 24 year	16.13	25.00	20.00
25 – 34 year	30.65	45.83	37.27
35 – 44 year	27.42	22.92	25.45
45 – 54 year	17.74	2.08	10.91
> 54 year	3.23	4.17	3.64
Male (%)	56.36	43.64	100.00
Education (%)			
Lower or middle	22.58	14.90	18.72
Higher	77.42	85.10	81.26
Continent (%)			
Europe +GB	9.09	8.18	17.27
North America	31.81	14.54	46.36
South America	2.72	4.54	7.27
Africa	3.63	2.72	6.36
Asia	9.09	13.63	22.72
Is the type of surface on the street important for a runner? (%)			
Yes	50.00	39.09	89.09
No	3.36	2.72	6.36
Unsure	2.72	1.81	4.55
What surface should be avoided? (%)			
Various high surfaces	13.63	16.36	29.99
Uneven and potholes surface	20.00	12.72	32.72
Cobblestones & bricks	11.81	6.36	18.17
Concrete	7.27	5.45	12.72
Asphalt	3.63	2.72	6.36
Positively influence the organization of the run (%)			
Lighting	15.45	20.00	35.45
Ramps	5.45	0.90	6.35
Tress and green area	4.54	0.90	5.44
Flat and smooth surface	17.27	10.00	27.27
Special line	0.90	3.63	4.26
Interesting architecture	7.27	0.90	8.17
Sidewalk connectivity	4.54	5.45	9.99
Negatively influence the organization of the run (%)			

Curbs	14.54	17.27	31.81
Street signs	8.18	7.27	15.45
Lighting	2.72	0.90	3.62
Various high surface	17.27	8.18	25.45
Street turn (curve)	2.72	0.90	3.62
Elements (bins, phone boxes, benches, hydrants, manholes, bumps, bollards, fences)	9.09	7.27	16.36
<b>Physical barriers, mean</b>			
Curbs	3.39	3.44	6.83
Cyclists	3.24	3.13	6.37
Cars	3.18	3.50	6.68
Signages (street signs)	3.27	3.44	6.71
Benches	3.13	2.98	6.11
Lighting	3.34	3.06	6.40
Trees and green area	3.34	3.17	6.51
Bins	3.05	2.96	6.01

### **3.3.2 Respondents' Perception of Important and Avoided Surfaces of the Running Environment for Disabled Runners**

Table 2 shows the results of an analysis of frequency data on the perceived importance of the running environment's surface, which was chosen at random from a group of 110 runners with disabilities (62 physically disabled runners and 48 visually impaired runners). One of the survey statements was their perception of what kind of street surface is important for a runner. 89.09% of the runners said yes, 6.36% said no, and 4.55% had no idea what was important on the street's surface.

Respondents were asked to indicate what surfaces should be avoided in the running environment (Figure 1). The indicated surfaces that should be avoided for both disabled runners were uneven and various high surfaces were more recorded than concrete and asphalt surfaces. Physically disabled runners were highly recorded for uneven surfaces at 20.0% and various high surfaces at 13.63%, compared to concrete at 7.27% and asphalt surfaces at 3.63%. Visually impaired runners were rated higher for various high surfaces at 16.36% and uneven surfaces at

12.72%, compared to concrete at 5.45% and asphalt surfaces at 2.72%. In addition, cobblestone surfaces at 11.81% and 6.36% for both physically disabled and visually impaired runners, respectively.

Table 2. Analysis of the frequency of the perceived importance of the running environment surface

	Physical disabled runners (N= 62; 56.36%)		Visually impaired runners (N= 48; 43.64%)		Total (N=110) %
	Frequency	Percent	Frequency	Percent	
Yes	55	50.00	43	39.09	89.09
No	4	3.36	3	2.72	6.36
Unsure	3	2.72	2	1.81	4.55

Table 3 provides that there was no significant relationship between disabled runners and the importance of the running environment surfaces,  $\chi^2(108) = 0.031, p > 0.985$ . The reason for this was those runners with physical disabilities and those who are visually impaired could agree on the importance of the running surface.

Table 3. Chi-square test of independence on perceived importance of the running environment surfaces.

Total (N=110)	$\chi^2$	df	P-value
110	.031 <sup>a</sup>	2	.985

### 3.3.3 Respondents' perception of the permanent street elements that positively and negatively influence the organization of running for disabled runners

Respondents were asked to rate the permanent street elements that positively influence the organization of running for disabled runners, including lighting, ramps, trees and green areas, flat surfaces, special lines, interesting architecture, and sidewalk connectivity (Figure 2). Physically disabled runners were frequently rated at 17.27%, 15.45%, 7.27%, 5.45%, 4.54%, 4.54%, and 0.9% for flat surfaces, lighting, interesting architecture, ramps, sidewalk connectivity, trees and green areas, and special lines, respectively. Visually impaired runners were frequently scored at 20.0%, 10.0%, 5.45%, 3.65%, 0.90%, 0.90%, and 0.9% for lighting, flat surfaces, sidewalk connectivity, special lines, ramps, interesting architecture, and trees and green areas, respectively.

Respondents were asked to rate the permanent street elements that negatively influence the organization of running for disabled runners, including curbs, street signs, lighting, and various-

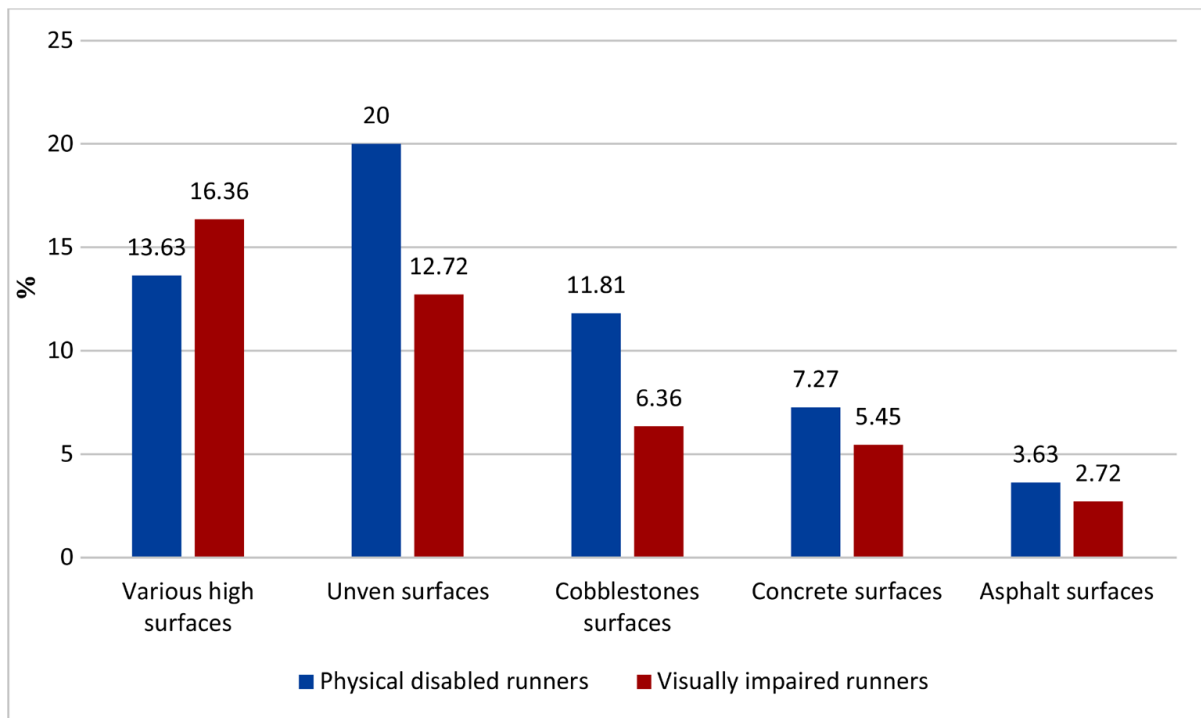


Figure 1. Distribution of respondents avoiding running surfaces for physically disabled and visually impaired runners.

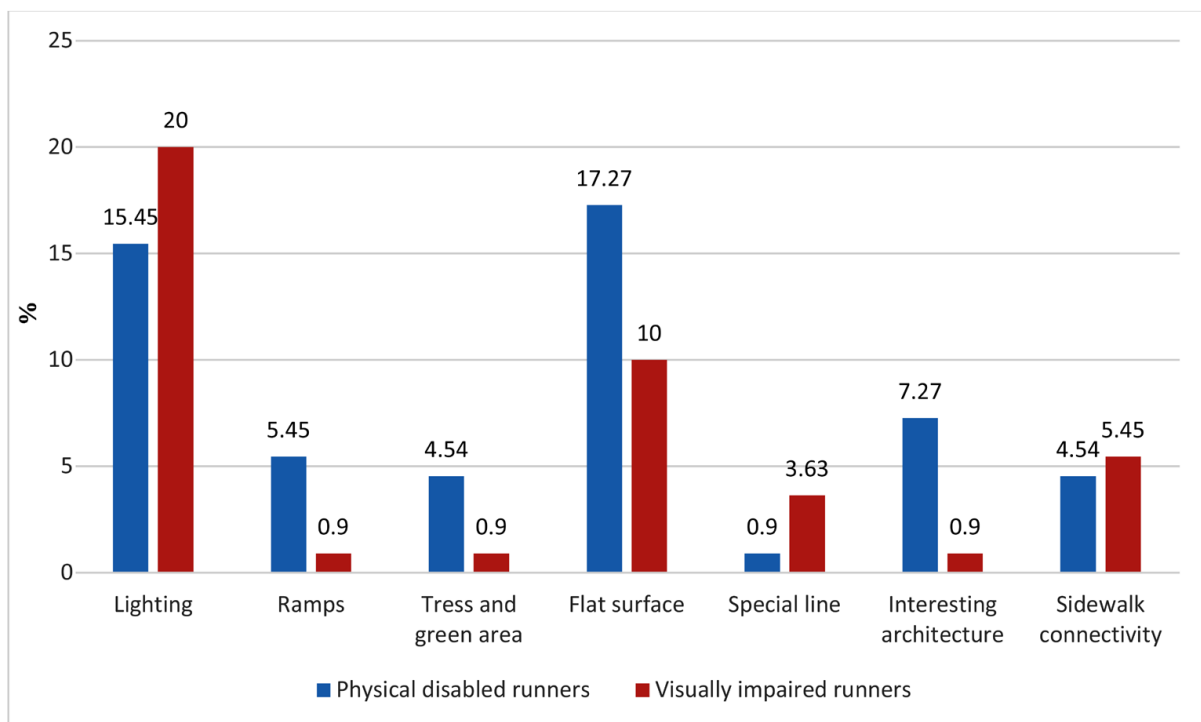


Figure 2. Distribution of respondents of the permanent street elements that positively influence the organization of running by physical disabled and visually impaired runners.

high surfaces, street turns, and elements (bins, benches, phone boxes, hydrants, bollards, manholes, etc.) (Figure 3). Physical disabled runners were frequently scored at 17.27%, 14.54%, 9.09%, 8.18%, 2.27%, and 2.27% for various high surfaces, curbs, elements, street signs, lighting, and

street turns, respectively. Visually impaired runners were frequently scored at 17.24%, 8.18%, 7.27%, 7.27%, 0.90%, and 0.90% for curbs, various high surfaces, street signs, elements, lighting, and street turns, respectively.

### 3.3.4 Respondents' Perception of the Barriers in the Running Environment

Table 4 provides descriptive statistics for both disabled runners. Regarding the questions for both types of disabled runners, rate the characteristics of the built environment that become the barriers to participation in street running. Physically disabled runners recorded significantly higher results for curbs, inappropriate position of lighting, street signs, and trees and green areas ( $M = 3.3$ ;  $SD = 1.17$ ,  $M = 3.3$ ;  $SD = 1.24$ ,  $M = 3.2$ ;  $SD = 1.14$ , and  $M = 3.3$ ;  $SD = 1.31$ , respectively) as barriers in the running environment compared to cyclists, cars, benches, and trash receptacles ( $M = 3.2$ ;  $SD = 1.12$ ,  $M = 3.1$ ;  $SD = 1.33$ ,  $M = 3.1$ ;  $SD = 1.23$ , and  $M = 3$ ;  $SD = 1.20$ , respectively).

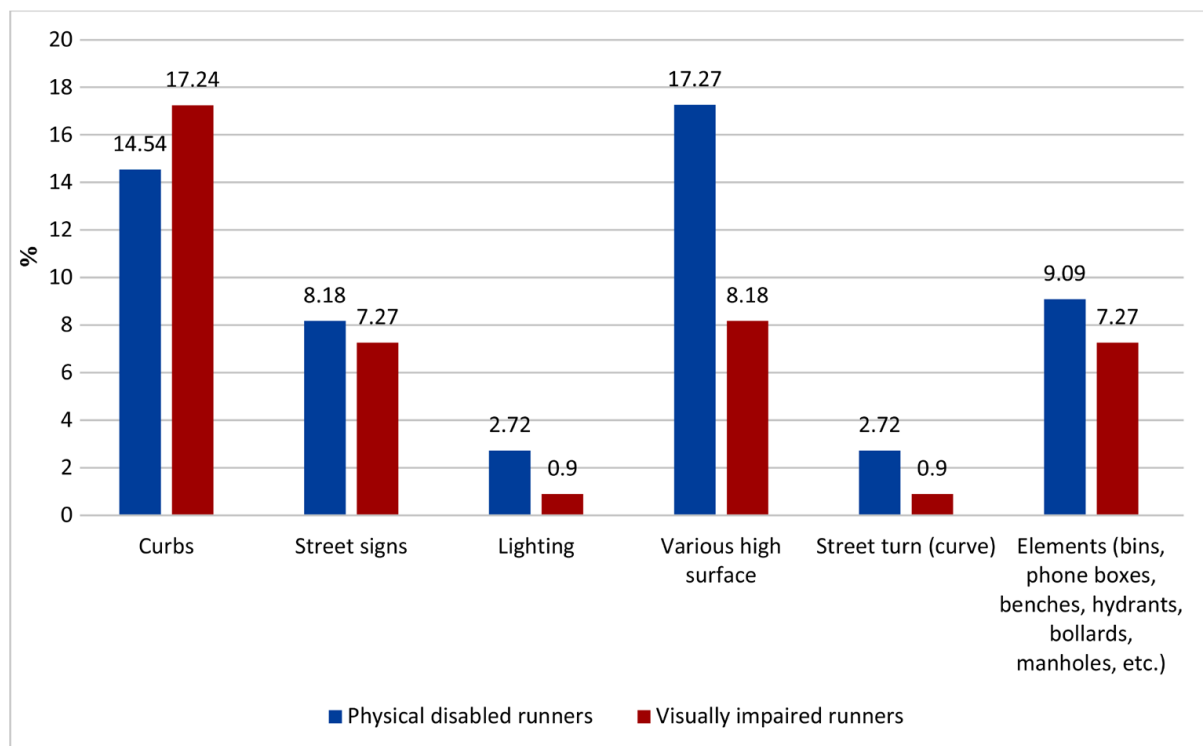


Figure 3. Distribution of respondents of the permanent street elements that negatively influence the organization of running by physical disabled and visually impaired runners.

Visually disabled runners recorded significantly higher results for cars, curbs, and street signs ( $M = 3.5$ ;  $SD = 1.23$ ,  $M = 3.4$ ;  $SD = 1$ , and  $M = 3.2$ ;  $SD = 1.14$ , respectively) as barriers in the running environment compared to cyclists, benches, lighting, trees and green areas, and trash receptacles ( $M = 3.1$ ;  $SD = 1.24$ ,  $M = 2.9$ ;  $SD = 1.21$ ,  $M = 3$ ;  $SD = 1.27$ ,  $M = 3.1$ ;  $SD = 1.35$ , and  $M = 2.9$ ;  $SD = 1.14$ , respectively). Conclusively, visually disabled runners more strongly suggest

that cars as a barrier as well as both disabled runners more frequently perceive curbs as a barrier to the running environment.

Table 4. Descriptive statistics of respondents' perception of the barriers of the running environment by physical and visually disabled runners.

<b>Variables</b>	<b>Physical and visually disabled runners</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Std. Error Mean</b>
<b>Physical disabled runners</b>	(N=62; 56.36%)			
Curbs	62	3.39	1.178	.150
Cyclists	62	3.24	1.126	.143
Cars	62	3.18	1.337	.170
Street signs	62	3.27	1.148	.146
Benches	62	3.13	1.235	.157
Lighting	62	3.34	1.241	.158
Tress & green area	62	3.34	1.318	.167
Trash receptacles	62	3.05	1.207	.153
<b>Visually disabled runners</b>	(N= 48; 43.64%)			
Curbs	48	3.44	1.050	.152
Cyclists	48	3.13	1.248	.180
Cars	48	3.50	1.238	.179
Street signs	48	3.44	1.183	.171
Benches	48	2.96	1.211	.175
Lighting	48	3.06	1.278	.185
Tress & green area	48	3.17	1.358	.196
Trash receptacles	48	2.96	1.148	.166

Table 5 shows the results of analyses of a t-test sample on respondents' perceptions of barriers in the running environment for both disabled runners. Physical disabled runners scored the barriers highly in the running environment for curbs, lighting, and trees and green areas ( $t(61) = 2.587, p < 0.05$ ,  $t(61) = 2.150, p < 0.05$ , and  $t(61) = 2.024, p < 0.05$ , respectively) than cyclists, cars, street signs, benches, and trash receptacles ( $t(61) = 1.691, p > 0.05$ ,  $t(61) = 1.045, p > 0.05$ ,  $t(61) =$

1.881,  $p > 0.05$ ,  $t(61) = 0.823$ ,  $p > 0.05$ , and  $t(61) = 0.316$ ,  $p > 0.05$ , respectively). Visually impaired runners scored the barriers highly in the running environment for curbs, cars, and street signs ( $t(47) = 2.887$ ,  $p < 0.05$ ,  $t(47) = 2.799$ ,  $p < 0.05$ , and  $t(47) = 2.561$ ,  $p < 0.05$ , respectively) than cyclists, benches, lighting, trees and green areas, and trash receptacles ( $t(47) = 0.694$ ,  $p > 0.05$ ,  $t(47) = -0.119$ ,  $p > 0.05$ ,  $t(47) = 0.339$ ,  $p > 0.05$ ,  $t(47) = 0.850$ ,  $p > 0.05$ , and  $t(47) = -0.252$ ,  $p > 0.05$ , respectively).

Table 5. t-Test on perceived barriers of the running environment by physical and visually disabled runners.

Variables	t	df	Sig. (2-tailed)	Mean Difference	95% CI Lower	95% CI Upper
<b>Physical disabled runners</b>						
Curbs	2.587	61	.012	.387	.09	.69
Cyclists	1.691	61	.096	.242	-.04	.53
Cars	1.045	61	.300	.177	-.16	.52
Street signs	1.881	61	.065	.274	-.02	.57
Benches	.823	61	.414	.129	-.18	.44
Lighting	2.150	61	.036	.339	.02	.65
Tress & green area	2.024	61	.047	.339	.00	.67
Trash receptacles	.316	61	.753	.048	-.26	.35
<b>Visually disabled runners</b>						
Curbs	2.887	47	.006	.438	.13	.74
Cyclists	.694	47	.491	.125	-.24	.49
Cars	2.799	47	.007	.500	.14	.86
Street signs	2.561	47	.014	.438	.09	.78
Benches	-.119	47	.906	-.021	-.37	.33
Lighting	.339	47	.736	.063	-.31	.43
Tress & green area	.850	47	.399	.167	-.23	.56
Trash receptacles	-.252	47	.803	-.042	-.37	.29

Both disabled runners stated that the curbs had become a hindrance to their running environment. Additionally, physical disabled runners have indicated that lighting and trees and green areas, while visually impaired runners have reported significant differences as cars and street signs become a barrier to their running environment. However, they scored less important results on the perception of barriers for cyclists, benches, and trash receptacles in the running environment.

### **3.4 Discussion**

This study examined perceived street surfaces and permanent street features that become impediments for physically disabled and visually impaired runners in mass street running in urban public spaces. The main finding of this study was that the perception of the importance of street surfaces and the physical attributes of streets in-between buildings has become a barrier that positively and negatively influences the organized running environment for disabled runners.

Physically disabled and visually impaired runners also agree about the importance of different types of running surfaces for runners. They indicated more frequently the surfaces to avoid in the running environment were uneven surfaces, various high surfaces, and cobblestone surfaces that have a negative relationship between them and the participation of disabled runners in street running. Furthermore, the risk of injury and harm to runners has increased [Collinson, 2008]. However, they are less visible in the running environment on the surfaces of concrete and asphalt. Jonas also asserted that running on the surface forces the runner's body to work and further concluded that asphalt is the best when compared with concrete and grass [Jared, 2018].

Physically disabled runners more frequently indicate the importance of permanent street elements that positively influence the organization of running in-between buildings, including flat surfaces, lighting, and interesting architecture. In addition, Robert Steuteville asserted that flat surfaces and attractive architectural features enable them to be adaptable for special events [Robert, 2020] and promote a running environment for all [Titze et al., 2005]. However, ramps, sidewalk and street connectivity, trees and green areas, and special lines were less concerned about positively influencing the organization of the race.

Visually impaired runners more frequently indicate the importance of lighting, flat surfaces, sidewalk connectivity, and special lines (tactile pavers) in the running environment that positively influence the organization of running in-between buildings. However, ramps, trees, and green areas were less concerned with positively influencing the running organization. The study noted that

trees (fallen branches) and ramps are a barrier for visually impaired people in the built environment [Rimmer, 2006; Martin, 2013].

Physically disabled and visually impaired runners more frequently indicate the importance of permanent street elements that negatively influence the organization of running in-between buildings, including various high surfaces, curbs, elements, street signs, and lighting. The study also revealed that inappropriate placement of street furniture [Sport England, 2010], poor lighting on running streets [Ettema, 2016; Deelen et al., 2019] have become barriers for street runners in running environments. Furthermore, Curbs, cyclists, cars, street signs, benches, lighting, trees and green areas, and trash receptacles are examples of perceived physical barriers in the running environment that have a negative impact on organizing street running for both physically disabled and visually impaired runners. As well as Curbs, lighting, and trees and green areas are perceived as barriers in the running environment by physically disabled runners, rather than cyclists, cars, street signs, benches, and trash receptacles. Visually impaired runners place a high value on barriers in the running environment, such as curbs, cars, and street signs, rather than cyclists, benches, lighting, trees, and green spaces.

Those physical barriers were found in this study that make it difficult to move in public spaces independently for all disabled runners. However, very few differences in perceived physical barriers between physically disabled runners and visually impaired runners in-between buildings were found. Furthermore, this study found that curbs, lighting, and trees and green areas were perceived as more of a barrier to physically disabled runners in the running environment.

The findings of this study reveal that improperly designing public spaces makes it difficult and prevents disabled runners from participating in street running independently. However, the interest in the participation of disabled runners in mass street running has increased. It is obvious that urban planners and policymakers need to give more priority to revitalizing public spaces for people with disabilities by developing accessibility to remove all the barriers in the physical environment that can be adapted for organizing various events, especially mass street running. It also participates in improving the quality of life of people with disabilities in urban public spaces. Further study can be conducted to investigate what physical attributes in the built environment can create attractive public spaces for disabled runners in order to increase and motivate participation in street running as well as women' s disabled runners can be taken into account for street running participation

## 3.5 Conclusion

Over the past few decades, mass street running has become one of the most popular sports for everyone that has taken place in public spaces. People with disabilities are becoming increasingly interested in participating in street running. Policymakers and urban planners are also aware that improperly designed public spaces become physical barriers for disabled runners to participating in street running independently.

This research found that perceived types of street surfaces should be avoided in running environments for both physically disabled and visually impaired runners, such as uneven and potholed surfaces, various high surfaces, and cobblestone surfaces. Furthermore, we found barriers in-between buildings that have a negative impact on the organization of running for disabled runners, such as curbs, cars, cyclists, inappropriate placement of street elements, signs, lighting, trees and green areas, benches, and bins. However, disabled runners perceive attributes in-between buildings that positively influence running organization and encourage participation of physically disabled runners, such as flat surfaces and interesting architecture, as well as for visually impaired runners, such as lighting, flat surfaces, sidewalk and street connectivity, and special lines. Urban practitioners should prioritize revitalizing in-between buildings through developing accessibility to remove all the impediments that may encourage and promote more disabled people to participate in street running.

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## **CHAPTER 4**

# **ENHANCING ACCESSIBILITY AND USABILITY OF OUTDOOR RECREATION SPACES FOR INDIVIDUALS WITH DISABILITIES: A CASE STUDY OF THE ACTIVITY ZONE IN CHORZÓW CITY, POLAND**

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## **Abstract**

Creating inclusive outdoor recreation spaces has become a popular worldwide trend for making attractive social spaces for everyone to participate in daily activities. However, this inclusive recreational public space is often inaccessible and unusable for all individuals, particularly people with disabilities, and these issues were noted in a case study in Poland. This paper aimed to evaluate the inclusivity of recreational outdoor spaces based on universal design guidelines and local accessibility standards, incorporating both qualitative and quantitative assessments to deeply understand the detailed elements needed to enhance accessibility and usability for people with disabilities within the Activity Zone in Chorzów City, Poland. Based on the findings in the selected case study, it can be concluded that some of the elements were insufficiently accessible and usable for people with disabilities due to a lack of practitioners' knowledge of universal design and local accessibility standards for application in the revitalization of outdoor public spaces. Therefore, several suggestions are presented for improving the selected case study. The significance of this research is to raise awareness and help local authorities collaborate with practitioners, considering UD principles and local standards, during the revitalisation of outdoor recreation spaces to meet the needs of diverse users.

## 4.1 Introduction

A global societal transformation is underway, marked by a growing elderly population and an estimated 15% of the world facing disabilities [1]. This trend poses a social challenge necessitating practical solutions in the built environment. Government bodies, scholars, and community organizations actively explore ways to address the needs of seniors and individuals with disabilities, focusing on improving living conditions, mobility, access to services, and overcoming urban challenges [2,3].

Recent years have seen an increased emphasis on ensuring accessibility for diverse populations, highlighting the importance of equal opportunities for active societal engagement [4- 6]. Universal design, recognizing its role in accommodating a broad spectrum of people, aims for inclusivity in urban environments [7]. Incorporating universal design principles requires consideration of regulations and codes established by countries striving for proper urbanization to meet disabled individuals' needs [8].

In parallel, efforts by planners, architects, engineers, and researchers have led to practical solutions in urban spaces, emphasizing inclusivity [3, 6, 9]. Outdoor recreation spaces play a crucial role in creating inclusive environments, attracting a diverse range of individuals, including those with disabilities.

Studies highlight key design features influencing outdoor play spaces' inclusivity, such as location, accessible pathways, inclusive play elements, safety features, and accessible parking [10-17]. Conversely, barriers include high curbs, narrow paths, irregular surfaces, lack of tactile paving, and insufficient play elements [10, 12, 13, 15-23, 37].

Despite prior studies identifying inclusive elements, these are often overlooked in outdoor play space revitalization due to a lack of practitioner knowledge in universal design. Furthermore, there has been very little exploration of the application of universal design to the design of outdoor recreation spaces and play spaces.

Additionally, no study from Poland examines the evaluation of the Active Zone (a multifunctional public space) considering inclusion for people with disabilities. This study aims to fill these gaps, evaluating the inclusivity of outdoor spaces based on universal design guidelines and local accessibility standards, to guide the creation of fully inclusive public spaces for all communities, including people with disabilities.

## 4.2 Universal design & Warsaw accessibility standards for outdoor recreation spaces

Over time, various terms have emerged to advocate for equal opportunities for individuals living in urban environments, including design for all, inclusive design, accessible design, usable design, adaptable design, barrier-free design, and universal design. Among these concepts, universal design stands out as a prominent approach [4, 8]. The term "universal design" was first used in the US by Mace in 1995, and it was defined as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design"[24]. This concept has gained significant recognition and endorsement from supranational bodies such as the United Nations (UN) and the World Health Organization (WHO). It has also permeated various levels of governance, including national and subnational governments and non-governmental and private sector organizations [9, 25-27, 38].

Furthermore, in 1997, the Center for Universal Design at North Carolina State University released the seven principles of universal design, authored by a group of esteemed experts. These principles present a holistic and inclusive perspective on universal design, providing valuable guidance for designers and evaluators. Each principle is accompanied by a set of guidelines that aim to enhance our understanding of universal design. By implementing these seven principles, the goal is to integrate accessibility and usability features, eliminating stigmatization and fostering the social inclusion of a wide range of users [3]. The seven principles of universal design such as [3, 9, 28, 29]:

1. **Equitable Use:** The design is useful and marketable to people with diverse abilities.
2. **Flexibility in Use:** The design accommodates a wide range of individual preferences and abilities.
3. **Simple and Intuitive Use:** Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
4. **Perceptible Information:** The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
5. **Tolerance for Error:** The design minimizes hazards and the adverse consequences of accidental or unintended actions.
6. **Low Physical Effort:** The design can be used efficiently and comfortably and with a minimum of fatigue.
7. **Size and Space for Approach and Use:** Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

Consequently, the concept of universal design is becoming an integral part of architecture, design, and urban planning. It is viewed as a holistic approach to enhancing the built environment to cater to the needs of individuals of all ages, sizes, and abilities [30-31]. As a result, several countries, including Norway, the Netherlands, Germany, Sweden, and others, have developed national action plans on universal design to ensure "equal and democratic rights in society for all individuals, regardless of their age, abilities, or cultural background" [33]. These countries have established construction standards, regulations, laws, and measures to guarantee equal rights for all individuals in society, which should also be implemented in public spaces. As well as, Poland serves as an exemplary country where most provinces have developed their accessibility standards, covering both indoor and outdoor areas. An examination of the set of accessibility standards for urban public spaces development in Polish cities reveals their accessible design for people with disabilities, including, sidewalks, squares, parks, streets, playgrounds, sports facilities, ramps, building stairs, toilets, pedestrian guides, TGSI - Invoice markings, parking spaces, city spatial information and urban furniture (benches, seating areas, signs, lightings, trash bins, etc.). Table 1 shows an example of several accessibility standards of Warsaw City [34].

### **4.3 Case study (activity zone)**

The Activity Zone in Chorzów, Poland, established in 2018-2019, is located in a wooded space previously occupied by demolished military buildings. It is positioned between university buildings and residential districts, connecting the University of Silesia campus with the city (Fig. 1). Designed as a versatile public space for students, university staff, and residents, it was created by SLAS Architects [35]. The area combines various activities and features an unconventional layout with creatively shaped concrete openings that accommodate lower beds or small gardens, fostering the growth of shrubs, grasses, herbs, and trees [36]. It promotes inclusivity with a nonsegregated play area for children and includes elements like benches, tables, and fitness devices evenly distributed throughout the entire zone. The design also aims to encourage adults to engage in children's activities. The Activity Zone has become a popular meeting place for individuals of all ages.

The study evaluates the elements of the Activity Zone based on seven principles of universal design, focusing on accessibility and usability. Qualitative analysis involves observation through photographs and measurements, while quantitative analysis employs Warsaw standards for accessibility. The paper categorizes elements such as ramps, surfaces, sports facilities, urban furniture, and parking spaces as appropriate or inappropriate based on compliance with established standards.

## 4.4 Findings and discussions

Based on the empirical evidence and in concurrence with the qualitative evaluation (Fig. 2-9), the research findings suggest that the examined elements of outdoor recreation spaces, including ramps (entrances), pathways (surfaces), play equipment, urban furniture (signs, lighting, benches, trash bins), and parking spaces, to some extent, embody the fundamental principles of Universal Design (UD).

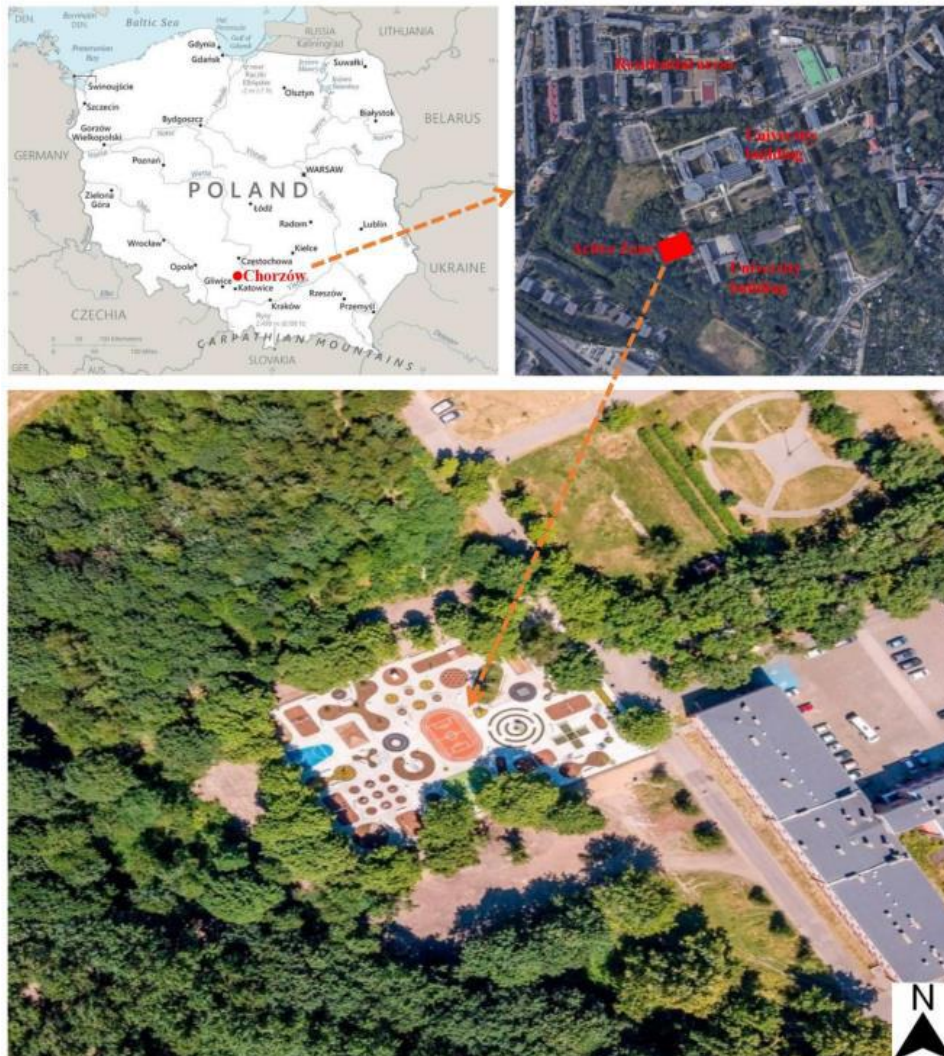


Figure 1: location of the Activity Zone in Chorzów, Poland

The ramp at the entrance is not sufficient for the principles of equitable use and low physical effort in universal design and is not accessible to all due to its elevated height level. The pathways are sufficient for the principles of low physical effort in universal design, as the surfaces are even, stable, and well maintained to facilitate easy movement for individuals using mobility aids such as wheelchairs or walkers. However, the pathways are not entirely free from barriers caused by some elements within the space. Additionally, they are not suitable for the principle of perceptible

information in universal design, as tactile indicators are not provided to assist individuals with visual impairments in navigating the space.

A few play areas are appropriate for the principles of flexibility in use in universal design as they provide full accessibility to users of all ages and groups. However, some of the equipment is not suitable for people with disabilities due to the existence of different levels. The trash bins demonstrate compliance with the principle of flexibility in use by offering a range of positions and appropriately sized options. Benches are in accordance with the principles of low physical effort and size and space for approach and use in Universal Design as they offer a variety of bench types to cater to diverse needs and are conveniently located throughout the recreation space.

In addition, the signs partially adhere to the perceptible information principle of universal design. While the information board provides a plan of the area with detailed explanations, visually impaired individuals are unable to comprehend the provided information. However, there is a lack of clear signage to assist and direct individuals to the parking areas. It is evident that the elements of the outdoor recreation space partially adhere to the principles of universal design, aiming to create a convenient and inclusive environment for all individuals.



Figure 2: Entrance



Figure 3: Pathway(surfaces)

Furthermore, a quantitative assessment based on the Warsaw Accessibility Standards was employed to measure the eight selected elements within the study area, as shown in (Table 1). Elements such as ramps, sports equipment, benches, lighting, and parking spaces are inadequate. Conversely, surfaces/pathways, trash bins, and signs are deemed sufficient.

Based on the evaluations, this research concludes that there is ample scope to establish an inclusive environment for all individuals, including people with disabilities, in the Activity Zone (multifunctional public spaces) in Chorzow City.



Figure 4: Play equipment



Figure 5: Trash bins



Figure 6: Benches



Figure 7: Lighting



Figure 8: Signs



Figure 9: Parking spaces

However, the case study demonstrates some overlooked Universal Design (UD) features when examined through the lens of the seven principles of universal design and Warsaw Accessibility Standards (WAS). Below, several suggestions are presented to enhance the Activity Zone in alignment with universal design principles and Warsaw Accessibility Standards (Section 6, Page 170, 2022) for outdoor recreational spaces that cater to everyone [34]. These suggestions encompass areas such as pathways, entrances, sports facilities, parking spaces, tactile elements, street furniture, toilets, and the overall design of the recreation space.

**Pathways:** It is essential to establish pathways that enhance the seamless connectivity of the Activity Zone with its surrounding areas, including residential zones, university buildings, and the main street. The following requirements are necessary for the accessible pathway design to adhere to the Warsaw Accessibility Standards, ensuring appropriate measurements and providing all necessary elements while strategically locating them along the pathways to accommodate everyone.

Table 1 Assessment of outdoor recreation space elements in Activity Zone based on Warsaw Standards

Outdoor recreation space elements	Size	Warsaw standards	Appropriate/ Neutral/ Inappropriate
Ramp(entrance)	Height: 12 cm	The minimum width of the ramp is 120 cm	Inappropriate
Pathway Surfaces	No ramps	No slippery slope from 6% to 8%	Inappropriate
	Varying in sizes	The pathways' width ranges from 180cm to 200 cm	Neutral
		The surfaces should be even, smooth, non-slip, and weather-resistant	Appropriate
Play equipment	Varying in sizes and types	Free from gaps	Appropriate
		Provided a tactile surface with a width ranging from 25 cm to 50 cm, featuring contrasts in texture, pattern, or color	Inappropriate
		Differentiating the ground surface of equipment using color and texture contrast	Appropriate
Trash bins	Height: 100 cm	Ramps facilitate access to all zones and play equipment	Inappropriate
		Provided information for all the equipment	Neutral
Benches	Benches (height and width: 45 x 45 cm) or (height:	Located outside the width of the obstacle-free pathways	Inappropriate
		The maximum height of the trash bin should be 130 cm, and the garbage disposal should not exceed a height of 100 cm	Appropriate
		Located on hardened surfaces	Appropriate
		Placed at a distance of 40-80 cm from the pathways	Inappropriate
		Avoid sharp edges	Neutral

	75 cm, width: 45 cm).	Benches with backrests and armrests are 75-80 cm in height and 40-45 cm in width.	Appropriate
	Table (height: 88cm, width:75 cm, depth: 53cm).	Without them, the height and width are 40-45 cm	
	Relaxing bench (height: 25 cm, Width: 90 cm).	The minimum dimensions of the table should be 70 cm in height, 90 cm in width, and 60 cm in depth, along with a minimum size of 150 cm x 150 cm provided to accommodate wheelchair users	Neutral
Lighting	Height: 400 cm	Located 100 cm away from the pathways Lighting fixtures should be placed along and illuminate the pathways	Inappropriate Appropriate
Signs	Height: 193 cm	A maximum height of 200 cm Placed near the entrances Provided clear information for everyone Reachable and visible to everyone	Appropriate Inappropriate Neutral Appropriate
Parking spaces	Dimensions of parking spaces: 3.6 m x 5 m. Distance from the entrance: 27 m and 50 m.	Provided parking spaces a maximum distance of 50 m from the entrance Visibly marked both vertically and horizontally Accessible pathways that lead to the entrance The dimensions of parking spaces should be either 3.6 m x 6 m or 3.6 m x 5 m A minimum of 5% of the total parking lot area should be designated for people with disabilities	Inappropriate Appropriate Inappropriate Appropriate Neutral

The pathways should be designed with a minimum width of at least 1.8 meters, ensuring they are obstaclefree. In order to allow two individuals with disabilities to pass each other freely, it is recommended to include local pedestrian extensions that are 2 meters wide and 2 meters long. These extensions should be positioned at a maximum distance of 20 to 25 meters, taking into consideration the pedestrian density.

The surfaces of the pathways should be even, smooth, non-slip, and weather-resistant. They must be free from gaps, or in the case of having gaps, the width should not exceed 1 cm. Tactile surfaces should be incorporated in the center of the pathways, with a width ranging from 25 to 50 cm. These surfaces should exhibit texture, pattern, or color contrasts to guide individuals with limited or no vision, enabling them to navigate and orient themselves independently.

**Street furniture:** The street furniture, including lighting elements, trash bins, and benches, should be located outside the width of the obstacle-free pathway, as specified in the outdoor recreation areas' accessibility standard section, with appropriate measurements.

**Ramps:** Ramps must be established at the entrance of the area. The construction of ramps should ensure a smooth and seamless transition between different pavement surfaces, promoting independent and barrierfree movement for all individuals, including those with disabilities. The dimensions of the ramp are mentioned in the accessibility standard section.

**Play equipment:** Rubber surfaces should be used to create a level and even playing area for certain elements of the recreation areas. This allows for smoother movement and makes the playing area accessible to all individuals, including those with disabilities.

**Toilets:** There are no toilets in the recreation area to encourage visitors to stay longer and enjoy their time. Therefore, accessible toilets should be established for all. Meeting specific standards is necessary when designing accessible outdoor toilets to accommodate individuals with disabilities.

The toilet compartment must have minimum dimensions of 2.2 x 2.2 m. It must provide a ramp for the entrance, and the level from the stairs outside the entrance and inside the toilet must be zero. Additionally, the width of the entrance door must be a minimum of at least 90 cm.

The space in front of the toilet should be at least 1.5 x 1.5 m, free of devices and equipment, with a 30-40 cm space behind the toilet. Furthermore, there should be a transfer space to the toilet bowl from two sides of the toilet bowl with dimensions of at least 90 cm wide and 1.4 m long.

It is recommended to have a seat height with dimensions of 45-48 cm and a minimum depth of 70 cm for the toilet bowl. The surface of the toilet must be smooth and non-slip, and an alert system must be available in place.

**Parking areas:** There are two parking areas nearby the recreation space, but they are currently not visible to visitors. Therefore, adding parking signs for both areas can make them visible to all visitors, and it is also essential to establish continuous accessible pathways that lead people with disabilities to the recreation area.

## 4.5 Conclusion

This study aimed to emphasize the significance of incorporating the concept of universal design, along with local standards and regulations, for evaluating the elements of revitalizing recreational public space (Activity Zone). The findings of this study conclude that the evaluated elements are

not entirely inclusive for all users, especially those with disabilities. Therefore, several suggestions are provided for improving the elements of the selected case study.

The significance of this study can help local authorities collaborate with practitioners, considering Universal Design (UD) principles and local standards during the revitalization of outdoor recreation spaces, to meet the needs of diverse users. Further research needs to be conducted on outdoor play and recreation spaces in various geographic areas, both within and outside Poland. This research should involve evaluation and comparison, such as identifying best practices, to determine the characteristics necessary for revitalizing recreation areas and creating inclusive play spaces for everyone.

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## **CHAPTER 5**

### **COMPARATIVE STUDY ON THE EVALUATION OF ACCESSIBILITY AND USABILITY OF PARKS AND PLAY AREAS FOR PEOPLE WITH DISABILITIES: A CASE STUDY OF HUNGARY, POLAND, IRAQ, AND SAUDI ARABIA**

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## **Abstract**

Public parks and play spaces offer areas for recreational activities that everyone can enjoy. Evaluating the accessibility and usability of these areas is vital, as their design, environmental features, and safety measures significantly impact the participation of people with disabilities. This study aims to evaluate and compare the accessibility and usability of outdoor play spaces in urban public parks for individuals with disabilities across four distinct countries. As well as to investigate how each country considers awareness and embraces laws to universally improve accessibility and usability for persons with disabilities in the planning and design of play spaces in public parks. Four urban public parks were selected as case studies, each located in a different country: Hungary, Poland, Iraq, and Saudi Arabia. The parks and play spaces were assessed and compared using a customized tool, with data analyzed using descriptive statistics. The findings demonstrate varying levels of accessibility and usability in the assessed public parks, according to international guidelines and national standards for parks and playgrounds. The study identified both appropriate and inappropriate accessibility and usability in play equipment, path surfaces, rest areas, restrooms, and car parking across all case studies. Notably, City Park in Budapest, Hungary, exhibited higher accessibility and usability in park and play spaces compared to Azadi Park in Sulaimani, Iraq. The study concludes by highlighting design, environmental, and safety barriers that impede the participation of people with disabilities in recreational activities. A more thorough assessment and comparison of public parks and play areas is necessary to address the needs of diverse users everywhere.

## 5.1 Introduction

Over 1 billion people, about 15% of the world's population, are estimated to be living with some form of disability [1]. The UN Convention on the Rights of Persons with Disabilities defines disability as “long-term physical, mental, intellectual or sensory impairments which, in interaction with various barriers, may hinder a person's full and effective participation in society on an equal basis with others” [2]. The prevalence of disability is increasing due to aging populations and the rise in chronic health conditions [1,3]. Individuals with disabilities are more likely to experience higher rates of cardiovascular disease, obesity, and physical inactivity compared to those who are able-bodied [4, 5, 9].

Many studies have highlighted the significant importance of involving people with disabilities in sports and physical activities for their health, as well as for boosting their self-esteem and well-being [6,7, 8, 10, 42]. Regarding these activities, many studies have found that urban public spaces, including parks, are ideal places for encouraging people of all ages, abilities, and backgrounds to come together and enjoy outdoor activities [11, 14, 15-17, 34, 42]. Studies have also revealed that enhancing accessibility and usability in parks and play spaces can make them more inclusive and appealing to everyone [12, 37].

However, many public spaces, including parks, are poorly planned and designed, making them unsuitable for all users and creating significant barriers for people with disabilities to participate in activities, including sports [12, 19, 20-23, 65]. Despite five decades since the disability rights movements (national and international standards and regulations) in regions such as North America, Europe, and the United Kingdom, which advocated for an end to inequality and aimed to create accessible built environments for people with disabilities, significant challenges remain. Recommendations and guidelines have emphasized improvements such as physical accessibility, wayfinding, inclusive playgrounds, raised garden beds, and the addition of assistive signage and disability representation [13,18,34]. However, people with disabilities continue to face exclusion in the design of public spaces [18, 25, 41]. Most parks fail to meet the needs of all individuals [18, 19,22, 25-37], highlighting a critical gap between established guidelines and their implementation in creating inclusive public spaces [44].

To address these issues, this study examines the key elements in four urban public parks and play spaces that create barriers to participation in sports and physical activities for people with

disabilities in different countries. It also investigates the awareness of local authorities and practitioners regarding the implementation of existing accessibility standards.

Additionally, the motivation for conducting this study stems from the limited research on evaluating the accessibility and usability of parks and play areas for people with disabilities, particularly in identifying key elements that create barriers and reduce their participation in sports and physical activities [12, 37]. Moreover, no studies have comprehensively examined these barriers across different geographic regions using a combination of qualitative and quantitative approaches. Specifically, only one study has referenced standards such as the U.S. Access Board's Summary of Accessibility Guidelines for Play Areas [43] and New Zealand's NZS 5828:2004 Standard for Playground Equipment and Surfacing for People with Disabilities [45].

To address these gaps, this study employs customized evaluation tools [37] to assess and compare play spaces in four urban public parks across different countries, investigating how local authorities and practitioners address accessibility issues. The parks were evaluated and compared based on relevant international standards to identify key elements in each park that act as barriers for people with disabilities. Furthermore, the study seeks to identify best practices in revitalized parks that could serve as examples for other local authorities and practitioners. By raising awareness of the challenges faced by people with disabilities in accessing recreational and physical activities, this research provides valuable insights to improve the inclusivity of recreational spaces worldwide.

## **5.2 Methods**

### **5.2.1 Defining terms and procedure**

This study evaluated and compared the accessibility and usability of urban public parks and outdoor play spaces in four cities across different countries, including Hungary, Poland, Saudi Arabia, and Iraq. In this evaluation and comparison, disability was defined as encompassing impairments, limitations in activities, and restrictions in participation. It highlights the adverse interaction between an individual with a health condition and their environmental and personal factors [37, 46]. Accessibility was described as the interaction between an individual's or group's abilities and the design and requirements of the physical environment. Usability, on the other hand, was defined as an assessment of how effective, efficient, and satisfactory it is to use a particular facility or service [14].

In this study, the authors intentionally selected four urban public parks of the same size in different countries to ensure that each park had play spaces. All the chosen parks are popular and attractive recreation areas. Photos of the evaluated play spaces were taken using smartphones to provide visual support for the evaluation findings. The final results were based on a retrospective analysis of these photographs. Data were collected over three months. The equipment used during the evaluations included pens, paper copies of the PARCS tool, a camera, a smartphone, and measuring tapes.

### **5.2.2 Validity and reliability of the PARCS tool (questionnaire)**

Based on the literature review, the PARCS tool was developed as a valid and reliable evaluation tool. It is specifically designed to measure the accessibility of parks and playgrounds for individuals with disabilities [37]. All accessibility measures were modified in accordance with the recommendations of the New Zealand Standard guide for buildings and associated facilities [NZS 4121:2001] [47]. The section on play areas was adapted from the U.S. Access Board Summary of Accessibility Guidelines for Play Areas [43], as well as the New Zealand Standard guide [NZS 5828:2004] for playground equipment and surfacing [45].

This study utilized the PARCS tool, which had been successfully implemented in a prior study. The tool's development and validation involved collaboration with CCS Disability Action (a disability advocacy organization in New Zealand), the Blind Foundation (of New Zealand), and representatives from three city councils, including town planners, park and recreation managers, and accessibility support groups. Following consultations with these groups and researchers, the tool was reviewed and adjusted. The objective was to determine if the PARCS tool adequately addressed all aspects of accessibility and usability issues for people with disabilities through this consultation [37].

The PARCS tool is divided into two parts: accessible routes and facilities and amenities. The accessible routes part covers parking spaces and path surfaces, while the facilities and amenities part includes play areas, rest areas, and restrooms.

### **5.2.3 Data analysis**

Data were carefully entered into an Excel spreadsheet, where they were verified and categorized. The analysis involved using descriptive statistics to calculate and present percentages for each evaluation question, offering a clear understanding of the results.

## 5.3 Results

This study evaluated and compared accessibility and usability of outdoor play spaces in urban public parks for four different countries including Hungary, Poland, Iraq, and Saudi Arabi. A summary of key results is presented in Table 1 and Figure 7. The results of accessibility and usability measures of individual sections of the play spaces in parks are described below.

Table 1. Evaluating accessibility and usability of play spaces in City Park (Hungary), Silesia Park (Poland), Azadi Park (Iraq), and King Fahd Central Park (Saudi Arabi)

Evaluation items	Evaluation questions	City Park in Budapest	Silesia Park in Chorzów	Azadi Park in Sulaimani	King Fahd Central Park in Maddnah
		Appropriate / Inappropriate			
Car parking spaces and bus stops	<ul style="list-style-type: none"> <li>Are there accessible car parks?</li> <li>Is the nearest bus stop within walking distance of the play space entrance?</li> </ul>	Appropriate Appropriate	Inappropriate Inappropriate	Inappropriate Inappropriate	Inappropriate Inappropriate
Path surfaces	<ul style="list-style-type: none"> <li>Are the main paths at least 1.5 m wide?</li> <li>Is the main path surface regular and even?</li> </ul>	Appropriate Appropriate	Appropriate Appropriate	Inappropriate Inappropriate	Appropriate Inappropriate
Play equipment access and usability	<ul style="list-style-type: none"> <li>Are the ground level components accessible?</li> <li>Are there accessible routes to at least 50% of the elevated components?</li> <li>Are there high contrast colours between play equipment and the orientation path?</li> </ul>	Appropriate Appropriate Appropriate	Appropriate Appropriate Inappropriate	Inappropriate Inappropriate Inappropriate	Appropriate Inappropriate Inappropriate
Lighting and fencing	<ul style="list-style-type: none"> <li>Is there adequate lighting in the play spaces or secondary paths?</li> <li>Is the play area fenced and at least 1.2 m high?</li> </ul>	Appropriate Appropriate	Inappropriate Appropriate	Inappropriate Inappropriate	Appropriate Inappropriate
Rest areas	<ul style="list-style-type: none"> <li>Is there a rest area?</li> <li>Is there a suitable space for a wheelchair to be placed beside the rest area?</li> <li>Is there a quiet, less stimulating and safe space to have peace or relax?</li> </ul>	Appropriate Appropriate Appropriate	Appropriate Appropriate Appropriate	Inappropriate Inappropriate Appropriate	Appropriate Inappropriate Appropriate
Restrooms	<ul style="list-style-type: none"> <li>Is there a restroom present?</li> <li>Is the path to the toilet accessible?</li> </ul>	Appropriate Appropriate	Appropriate Appropriate	Appropriate Inappropriate	Appropriate Inappropriate

### 5.3.1 Car parking spaces and bus stops

King Fahd Central Park offers numerous car parking areas conveniently located near all activities. However, despite having designated accessible parking spaces, they lack appropriate signage for people with disabilities and fail to meet the recommended dimensions of 3.5 meters in width and 5 meters in length. Additionally, these spaces are missing access aisles on both sides, which should be at least 1 meter wide. The play spaces in the park also do not have bus stops within walking distance of their entrances.

Similarly, Azadi Park features a central parking area but lacks signage for people with disabilities, and the parking spaces do not meet the recommended dimensions or include access aisles on both sides. Moreover, there is no bus stop within 20 meters of the play space entrance.

Silesia Park has several car parking areas, a few of which are near the activities. However, most are not designated as accessible and lack proper signage. Only one accessible parking space meets the required dimensions and has access aisles on both sides (Figure 1, 6). Additionally, none of the play spaces have bus stops within 20 meters walking distance.

In contrast, City Park provides car parking areas, including designated accessible parking spaces that meet dimensional requirements and have access aisles on both sides for people with disabilities, but these are not near the play spaces. The park also features bus stops within 20 meters of the play space entrances (Table 1).



Figure 1. An example of a designated parking space for people with disabilities near a play area in Silesia Park, Poland.

### 5.3.2 Path surfaces and lighting

King Fahd Central Park features primary pathways exceeding 1.5 meters in width, yet it lacks tactile markings to indicate changes in direction. Although 50% of the pathways have smooth surfaces, none are interconnected with accessible ramps (Figure 2, 6). However, the park provides adequate lighting along the paths leading to various activity and play areas.

Azadi Park's main pathways are narrower than 1.5 meters and similarly lack tactile markings for directional changes. Most of these pathways are uneven and not interconnected by accessible ramps. Additionally, the park suffers from inadequate lighting along the paths leading to activity and play areas.

Silesia Park boasts pathways wider than 1.5 meters, and some have tactile markings to signal changes in direction. While several paths are regularly surfaced, many are interconnected by accessible ramps. However, the park is deficient in adequate lighting along the paths leading to various activity and play areas.

Similarly, City Park offers pathways wider than 1.5 meters and is insufficiently well-equipped with tactile markings to indicate directional changes. Most paths feature even surfaces and are interconnected by accessible ramps. Moreover, the park ensures adequate lighting along the paths leading to various activity and play areas (Table 1).



Figure 2. An example of a high curb and stairs along the main path of play space in King Fahd Central Park, Saudi Arabia.

### 5.3.3 Play equipment access and usability

Most play equipment components at ground level in King Fahd Central Park had an accessible route, unlike Azadi Park. However, many of the surfaces lacked stability for accessing the play equipment, and there was no fencing around the play spaces for both Parks. The play equipment featured high-contrast colors. In contrast, City Park's play equipment had accessible routes and surfaces with high-contrast colors between the play equipment and the orientation path (Figure 3, 5). The play spaces were also surrounded by standard fencing. Furthermore, Silesia Park had mostly accessible play equipment components, but the play equipment and orientation paths featured low-contrast colors compared to City Park. The play areas in Silesia Park were also fenced (Table 1).

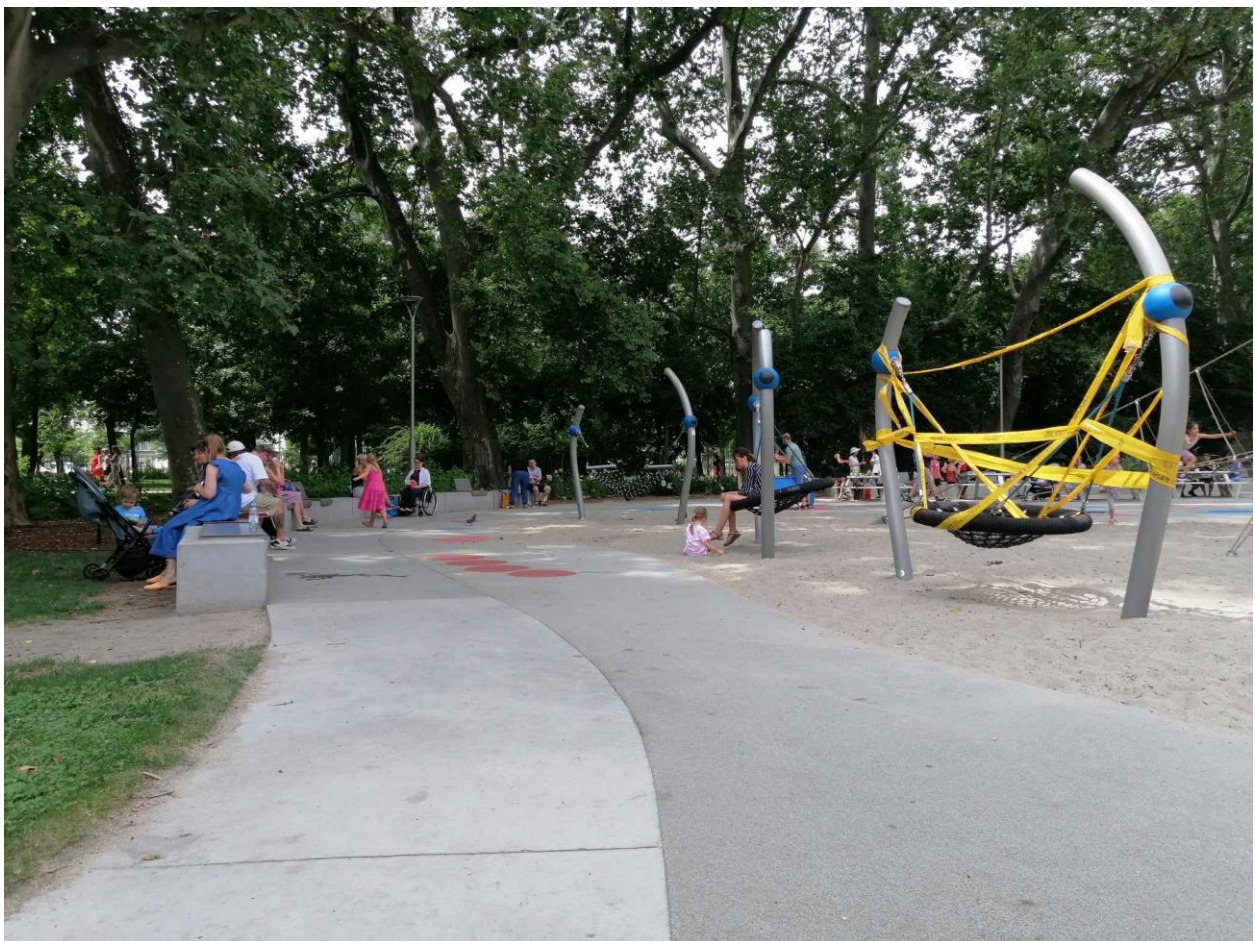


Figure 3. An example of play equipment and a rest area in City Park, Hungary.

### 5.3.4 Rest areas

All parks had places to sit or rest near the play areas (Figure 5). Most parks had armrests on the seats, and all seating followed height recommendations, falling between 0.40 meters and 0.52 meters. King Fahd Central Park, Silesian Park, and City Park provided an area for children

and parents, but only King Fahd Central Park had a fenced area for safety, though it lacked an accessible path leading to it. Most seats in Azadi Park were of poor quality and unsafe (Table 1).

### 5.3.5 Restrooms

King Fahd Central Park provided sufficient restrooms, each connected by accessible pathways. While most of these facilities are accessed via stairs, some are equipped with ramps. However, the ramps are constructed with non-standard angles, resulting in slippery and potentially inaccessible conditions. Moreover, most restrooms are located more than 20 meters away from the play areas. Additionally, none of the restrooms are equipped with power-assisted doors, push-button entry systems, or automatic doors.

Azadi Park had a few restrooms, but all are inaccessible due to stair-only access routes (Figure 4, 5). None of the toilets have push buttons or automatic doors, and most restrooms are located more than 20 meters away from the play areas.

Silesia Park had many restrooms. All toilets had accessible routes; however, most were accessed by ramps. A few were located more than 20 meters away from the play area. None of the toilets had power-assisted doors, and none opened automatically.

City Park had sufficient restrooms. All toilets had accessible routes, and most were located less than 20 meters away from the play area. A few toilets had power-assisted doors and push buttons to open the doors, but none opened automatically.



Figure 4. An example of stairs on the main path to the restrooms in Azadi Park, Iraq.

## **5.4 Discussion**

This study evaluated and compared the accessibility and usability of outdoor play spaces within four urban public parks using a customized evaluation tool (PARCS) [37], which Based on the national standards (NZS 4121: 2001 and NZS 5828: 2004) [45,47,48] or international guidelines [43], for park and playground design, in different countries including City Park (Hungary), Silesia Park (Poland), Azadi Park (Iraq), and King Fahd Central Park (Saudi Arabi). This study identified several key areas concerning the design, environment and safety of the parks and play spaces, potentially creating barriers to participation of persons with disabilities.

According to this evaluation, play spaces in four urban public parks were assessed. In comparison, City Park met the national standards and international guidelines for park and play space design. In contrast, Azadi Park did not meet these standards for people with disabilities. Additionally, some elements within play spaces had missed the accessibility and usability in King Fahd Central Park and Silesia Park, affecting participation for people with disabilities. Research indicates that involving individuals with disabilities in the planning and design of parks and playgrounds significantly enhances their engagement and satisfaction within these recreational spaces [50,51].

### **5.4.1 Car parking spaces and path surfaces**

The availability of accessible parking spaces is recognized as a significant facilitator in enhancing physical activity and the utilization of recreational environments by individuals with disabilities [22,51,52]. However, this study found that only City Park had accessible car parking, while Silesia Park , Azadi Park and King Fahd Central Park were inaccessible. None of the parks assessed adhered to all the recommended dimensions for a fully accessible parking space. This highlights the necessity for increasing the number of accessible parking spaces and updating the existing ones to comply with the recommended guidelines, ensuring they are fully usable.

For individuals with disabilities, mobility devices are essential for safe and comfortable access to public areas. Over 65 million people worldwide use wheelchairs, making them one of the most common mobility aids [53]. Moreover, the use of mobility scooters by older adults is growing both nationally and globally [54]. Our study found that Azadi Park and King Fahd Central Park had several issues, such as high curbs, narrow paths, and uneven surfaces, unlike

City Park and Silesia Park. These problems create challenges for using mobility devices and pose potential safety risks. Our results are consistent with previous studies that identify irregular path surfaces as significant barriers to outdoor physical activities for individuals with disabilities [23, 25, 37].

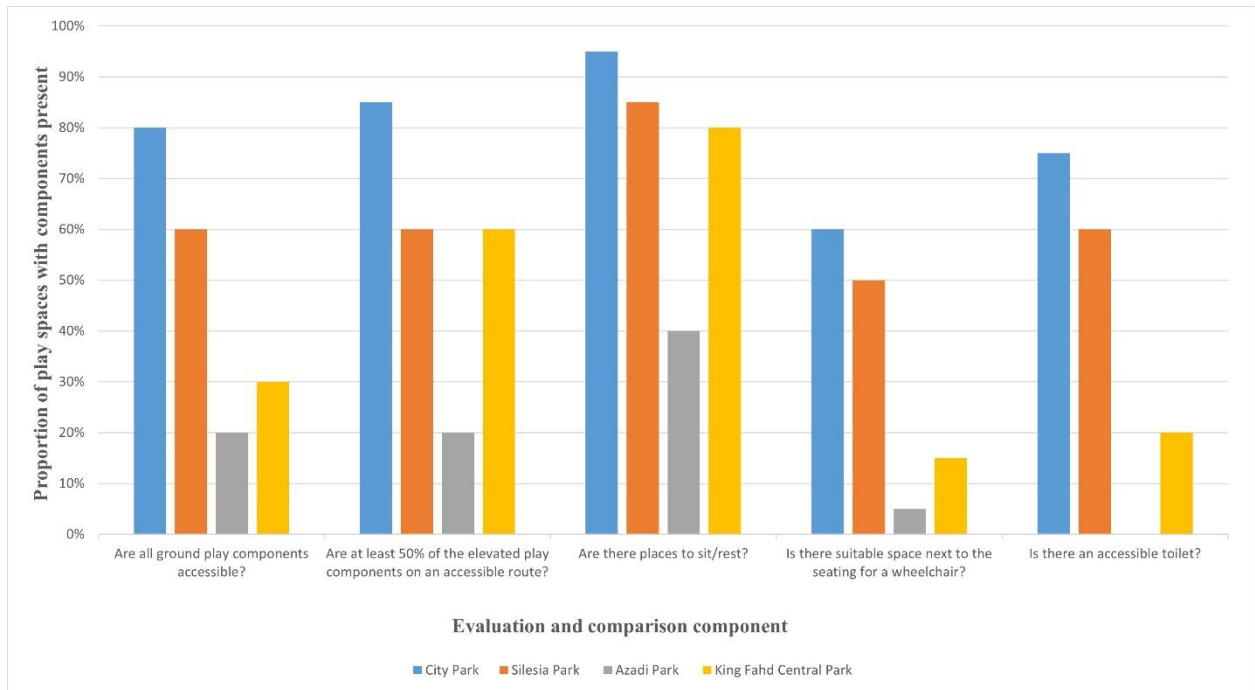


Figure 5. A comparison of access routes, rest areas, and restrooms across all public parks.

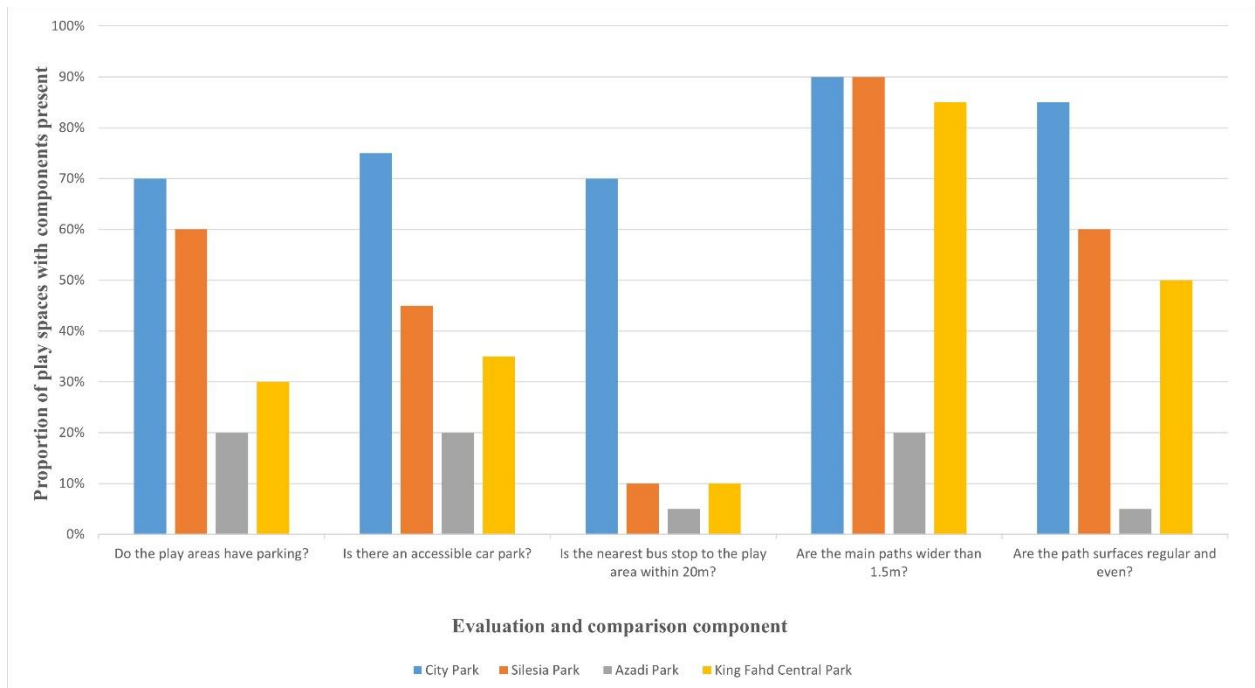


Figure 6. A comparison of parking and path surfaces across all public parks.

#### **5.4.2 Play equipment access and usability**

Transfer systems connect ground-level routes with elevated play equipment in park play areas. These systems, which include appropriate steps, are essential for providing a continuous and accessible route to elevated play components [43]. Without transfer systems, individuals requiring mobility assistance would likely be excluded from these play experiences. In City Park and Silesia Park, most play spaces have flat surfaces without steps from the orientation path to the play equipment, making the areas more accessible. However, in both Azadi Park and King Fahd Central Park, most play equipment lacks accessible routes to ground-level components, making the play areas extremely difficult for persons with disabilities to use.

Play enhances brain development across all ages by fostering new neural connections [55]. For individuals prone to overstimulation, like those with autism spectrum disorder, the calming effect of carefully chosen plants can be particularly beneficial [56, 57]. Features such as telescopes, mirrored structures, vibrant colors, lights, bells, chimes, talking tubes, sand areas, and diverse plant life are especially relevant for people with disabilities. These elements provide varied learning experiences and require little physical effort to enjoy [58]. However, only Azadi Park is insufficient for these inclusive features.

#### **5.4.3 Fencing**

The main purpose of a fence is to establish a secure environment where children of all abilities can safely play within a designated area. While not mandatory, the decision to install fences and gates should follow a thorough risk assessment that considers various hazards such as nearby water bodies, roads, dogs, and reduced visibility due to vegetation or structures [59]. A significant number of individuals on the autism spectrum are prone to wandering, which may influence caregivers' decisions to visit unfenced parks or playgrounds [37]. In accordance with New Zealand law [62], outdoor fences must be secure to prevent unsupervised access by children [61]. New Zealand and International guidelines recommend playground fences to be at least 1.2 meters high with gaps no wider than 100 mm [60]. In the evaluation of four public parks, we found that only City Park and Silesian Park provided fencing for play spaces. However, fencing can be expensive and may unintentionally hinder inclusivity due to narrow entry points and concerns about entrapment.

### 5.4.4 Lighting

In this study, we found that King Fahd Central Park and City Park provided sufficient lighting along circulation paths. However, only the play spaces in King Fahd Central Park and Azadi Park had appropriate lighting. According to Project for Public Spaces, lighting is the most requested design feature for increasing safety [63]. The main focus for lighting should be on primary pedestrian walkways. More lighting encourages greater use of parks, which helps to naturally monitor the area, reduce crime, and align with CPTED guidelines [64]. Despite this, the vast majority of Silesian Park and Azadi Park, including their primary access routes, lacked lighting. It is recommended that adequate lighting in multi-purpose areas like tennis courts, basketball courts, skate parks, and playgrounds would promote evening activities for older children and adults [25].

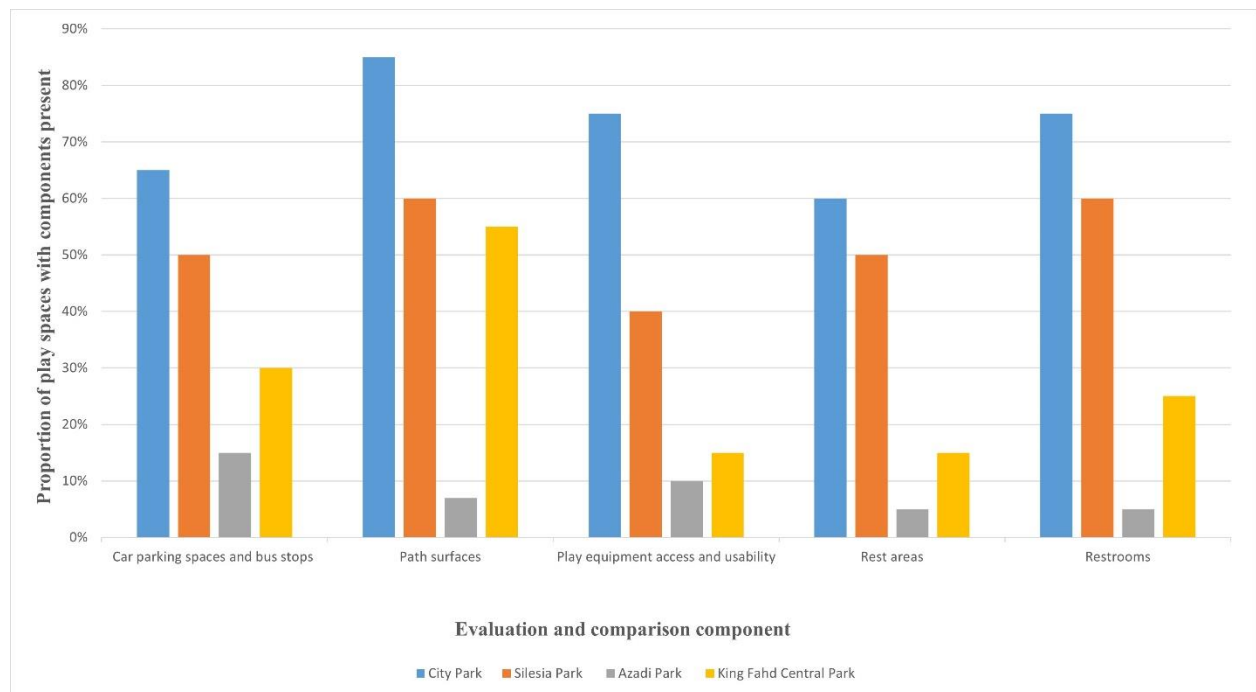


Figure 7. A comparison of all evaluated items, including parking and path surfaces, play equipment, rest areas, and restrooms across all public parks.

## 5.5 Limitations

This study is the first to evaluate and compare the accessibility and usability of play spaces in urban public parks across different countries using an evaluation tool designed for persons with disabilities. However, it is important to recognize the following limitations when interpreting the results: Firstly, the PARCS tool used to assess play space elements is not fully validated and requires further psychometric testing. This limits the generalizability of our study

results. Future research should conduct additional psychometric assessments of the tool. Secondly, this study was limited to evaluating only four urban public parks. Including more parks for evaluation and comparison would have strengthened the robustness of our findings. Finally, the assessment of safety for each item in all play spaces within the parks was not a primary focus of this study. However, we noted at least one safety risk at each park, including issues with path surfaces and play equipment. Future research should conduct more comprehensive safety evaluations of play spaces to encourage greater participation in physical activities by people with disabilities in outdoor recreational areas.

## **5.6 Conclusion**

Outdoor play spaces are essential for ensuring equal accessibility and usability, especially for individuals with disabilities. This study evaluating and comparing four public parks highlighted several issues: accessible car parking, path surfaces, access to play equipment, restroom facilities, fencing, and lighting. These issues can create barriers to leisure and physical activity participation for people with disabilities. A comprehensive assessment of parks and play spaces worldwide, tailored to each country's specific needs and using a valid and reliable assessment tool, is necessary to determine their accessibility and usability. This would enhance opportunities for leisure activities for everyone, especially those with disabilities.

The purpose of this study was to identify key areas in the design, environment, and safety of parks and play spaces that might prevent people with disabilities from participating. The study examined parks in four countries, including Hungary, Poland, Iraq, and Saudi Arabia. Researchers used a customized tool called PARCS for the evaluation, which is based on national standards (NZS 4121: 2001 and NZS 5828: 2004) and international guidelines.

- City Park (Hungary) stands out as a model of accessibility, adhering to national and international standards. It offers inclusive design features such as accessible pathways, play areas, and restrooms, enabling people with disabilities, older adults, and families to enjoy the park independently. This park demonstrates how thoughtful planning can promote social inclusion, community engagement, and quality of life.
- Silesia Park (Poland) has notable shortcomings, including inadequate lighting, inaccessible parking, poorly designed public transit stops, and restrooms that do not meet the needs of people with disabilities. While the park requires targeted

improvements such as better lighting, accessible parking, and inclusive restrooms addressing these gaps could transform it into a more welcoming space for all users.

- Azadi Park (Iraq) faces significant accessibility challenges, with uneven pathways, limited play equipment access, inadequate safety measures, and substandard lighting. These issues exclude a large portion of the population, particularly individuals with disabilities. A comprehensive redesign using universal design principles is essential to make the park inclusive and set a precedent for accessible public spaces in Iraq.
- King Fahd Central Park (Saudi Arabia) also has critical accessibility issues. Key problems include irregular pathways, poorly placed bus stops, inaccessible play areas, and inadequate restroom facilities. Substantial upgrades, such as smooth pathways, better transit access, fenced play areas, and universally accessible restrooms, are needed to make the park inclusive and usable for everyone.

In summary, while City Park exemplifies best practices in accessibility, Silesia Park and King Fahd Central Park require targeted upgrades, and Azadi Park demands a complete transformation. These comparisons highlight the critical role of inclusive design in ensuring equitable access and fostering community cohesion.

This study emphasizes the critical importance of involving people with disabilities in the planning and design of parks and play spaces. Their participation ensures that the needs and perspectives of all users are considered, leading to more inclusive and functional public spaces. By incorporating their insights, local authorities and practitioners can significantly enhance accessibility, usability, and overall satisfaction, making these spaces welcoming for everyone.

This approach is especially vital in regions like Iraq and Saudi Arabia, where existing parks, such as Azadi Park and King Fahd Central Park, have demonstrated significant accessibility challenges. Revitalizing public spaces with input from people with disabilities not only addresses these issues but also fosters social inclusion, equity, and community engagement. Including diverse voices in the planning process transforms parks into shared spaces that reflect the needs of all members of society.

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## **CHAPTER 6**

### **CONCLUSION & RECOMMENDATIONS**

## **6.1 Sport, outdoor public space, and people with disabilities**

This thesis focuses on the relationships between sports, the design of physical characteristics of outdoor public spaces, and everyone, particularly individuals with disabilities. In this thesis, outdoor public spaces refer to city centres, parks, playgrounds, spaces, and spatial sports facilities where sporting events are taking place. The main aim of this thesis was to provide a critical evaluation of the accessibility of the physical design features of outdoor recreational spaces in various geographical areas aimed at promoting people with disabilities in participation sports, based on universal design principles and international and national standards.

Inclusive sports are a means of fostering social equity by emphasising the promotion of accessibility in outdoor urban environments. This thesis contributes to empirical knowledge by addressing three key research gaps. This thesis offers an understanding of:

*1)* Despite growing awareness of the importance of urban public spaces in promoting sports for all, there is limited understanding of the specific factors that encourage or hinder participation. Therefore, a comprehensive analysis is needed to identify what characteristics influence the design of urban public spaces in shaping sports cities for everyone.

*2)* The city centre has become a venue for organising street runs, along with an increasing interest in participation among people with disabilities. Still, there has been limited research on how features of public spaces impact disabled runners. This thesis explores the perceived physical barriers in urban public spaces—precisely the spaces in-between buildings that hinder the independent participation of disabled runners.

*3)* The participation of people with disabilities in recreational areas is limited due to design, environmental, and safety barriers. To deal with this problem, this thesis looks into and rates the physical features of outdoor recreation areas. It also uses both qualitative and quantitative methods to understand what makes it hard for disabled people to use recreational and play areas on their own, according to universal design and accessibility standards.

This concluding chapter presents a summary of key findings and outlines future research directions. It closes with practical recommendations for policy and practice in urban planning, people with disabilities, and sports.

## 6.2 Summary of main findings

To achieve the main aim of this study, four research questions were developed. This section summarises and explains the key findings from chapters 2–5, which address the following research questions:

### **1. What factors facilitate or hinder sports participation, and how do they shape urban public spaces to create inclusive, accessible sports cities for everyone?**

The results of Chapter Two showed that spatial sports facilities, organisation and programming, and environmental factors impacted the creation of attractive environments for the organisation of informal sports for all in urban environments.

This research finds that increasing the number of sports facilities, ensuring their proximity to residential areas [1–3], and ensuring easy access and safety for sports facilities [4–9] can encourage diverse groups of individuals, including those with disabilities and the elderly, to engage in sports. However, this study finds that distance, inequitable access, and the uneven distribution of outdoor sports facilities in neighbourhoods can discourage sporting participation. Additionally, sports facilities can serve as social meeting places, contributing to the image of sports cities that are welcoming to all.

Organising and programming multisport activities for all groups at different times can create lively outdoor urban environments and shape sports cities [10]. The results of this study show that different participation and collaboration with multiple agencies and informal groups increase engagement in sports as well as make strong social relationships between participants, which can increase the frequency of participation in sports [11–16]. However, some organisers act as barriers, leading to conflicts and reduced participation. Therefore, to address this issue, it might be necessary to permit diverse community groups to plan some of these events [11]. This thesis finds that public spaces can serve as a venue for organised and non-organized sports [12, 17–20], as well as enable the programming of a wide range of sporting events proximate to residential areas, thereby creating more opportunities for all city residents and leading to higher participation in sports. However, further findings in this study indicate that sports organisers use public places for marketing and revenue generation, which negatively impacts participants [21, 22]. Additionally, management and maintenance issues are frequently overlooked in the design of public open spaces [23]; as a result, our results also show that collaboration between local governments and private parties is critical.

The quality of the urban environment highly influences outdoor sports. Attractive outdoor spaces could increase the frequency of participation in sports [24]. The research findings indicate that natural areas, such as green and blue spaces and water features, play a crucial role in creating attractive locations where a growing number of people engage in sports and physical activities. Additionally, the environmental quality of sporting venues, such as comfortable surfaces, feelings of safety, and living environments, can encourage participation in sports. Additionally, the environmental quality of sporting venues, such as comfortable surfaces, feelings of safety, and living environments, can encourage participation in sports. However, our results indicate that the lack of accessibility for all people and various safety issues (poor lighting, cars, cyclists, and unleashed dogs) are the challenges for people to participate in outdoor sports [25-27]; therefore, having access to sports facilities can play a significant role in increasing sport participants [8].

According to our results, the urban and architectural characteristics of public spaces in modern cities, such as aesthetics and intriguing design, as well as accessibility for all age groups, including people with disabilities, can entice people of all ages to participate in sports and physical activities. It is important to consider safety and attractiveness in the physical environment, as they can significantly impact sports participation. Inclusivity and multifunctionality are important factors in the planning and designing of urban regeneration programs to adapt public spaces into more accessible places for all [25, 28-30]. Doing this may encourage everyone to take part in sports.

To conclude, this chapter found that urban public spaces are important locations for informal sports activities. It is important to have well-designed public spaces to encourage everyone to participate in sports. This study found the factors that facilitate or hinder sports participation in urban public spaces. The factors that need to be integrated include spatial sports facilities factors (e.g., location, accessibility, relation with public space, distance and proximity, visibility, and opening), organisational and programmatic factors (e.g., program mix, developing sports spaces and facilities, maintenance, and policy and target group), and environmental factors (e.g., quality of sport surfaces, accessibility, natural spaces, adapting, and attracting spaces).

**2. What physical features in urban public spaces create barriers for physically and visually disabled street runners, and how can these barriers be identified and addressed to improve accessibility in the running environment?**

The findings of Chapter Three indicated that the assessment of perceived street surfaces and permanent street features poses a barrier for physically disabled and visually impaired runners in the context of mass street running.

This research found that certain types of street surfaces should be avoided in running environments for both physically disabled and visually impaired runners, including uneven and potholed surfaces, various elevated surfaces, and cobblestone pathways. Furthermore, we identified barriers in-between buildings that negatively affect the organisation of running for disabled runners, such as curbs, vehicles, cyclists, inappropriate placement of street elements, signage, lighting, trees and green areas, benches, and bins. However, disabled runners recognise attributes in-between buildings that positively influence running organisations and encourage the participation of physically disabled runners, such as flat surfaces and interesting architecture, as well as those for visually impaired runners, including lighting, flat surfaces, sidewalk and street connectivity, and tactile pathways.

This research concluded that poorly designed public spaces hinder and prevent disabled runners from participating in street running independently. Therefore, urban practitioners need to prioritise revitalising in-between buildings through accessibility development to remove all the impediments that may encourage everyone to participate in street running.

### **3. What specific design interventions and accessibility improvements are needed to optimise the inclusivity and usability of the Activity Zone in Chorzów City, Poland, for individuals with disabilities, based on universal design principles and local standards?**

The results of Chapter Four revealed the significance of incorporating the concept of universal design along with Warsaw Accessibility Standards and regulations for evaluating the elements of revitalising recreational public space (the Activity Zone in Poland) for people with disabilities. The elements include entrances, pathways, surfaces, play equipment, urban furniture (signs, lighting, benches, trash bins), and parking spaces.

This thesis found that the entrance is not accessible to all due to its elevated height level. The pathway surfaces are level, stable, and well-maintained to enable effortless movement for people using mobility aids, such as wheelchairs or walkers. However, the pathways are not entirely free from barriers caused by some elements within the space as well as a lack of tactile indicators to assist people with visual impairments in navigating the recreation space.

Some play areas are accessible to users of all ages and groups. However, a few of the equipment spaces are not accessible to people with disabilities because of the different surface levels. The trash bins in the area offer various placements and suitably sized options. Some benches provide a variety of types to cater to diverse needs; they are conveniently located throughout the recreation area and provide proper space for approach and use, but not all existing benches are suitable for people with disabilities to use. Although the area provides adequate lighting, its placement can pose a barrier. The information board provides a plan of the area with detailed explanations; however, visually impaired individuals are unable to comprehend the provided information. In addition, there is a lack of clear signage to assist and direct individuals to the parking areas.

Based on assessments of Universal Design (UD) and Warsaw Accessibility Standards (WAS) [31, 32], this study concluded that the Activity Zone (multifunctional public spaces) overlooks some features that make it a more welcoming recreational place for everyone.

#### **4. What are the differences in accessibility and usability of outdoor play spaces for individuals with disabilities in urban public parks across Hungary, Poland, Iraq, and Saudi Arabia, and how do national policies, awareness, and planning practices impact the design of inclusive play environments in these countries?**

The results of Chapter Five revealed key important issues related to the design, environment, and safety of parks and play spaces, potentially impeding the involvement of people with disabilities in four urban public parks in different countries, including City Park (Hungary), Silesia Park (Poland), Azadi Park (Iraq), and King Fahd Central Park (Saudi Arabia). This thesis evaluates and compares several issues in the parks: accessible car parking, path surfaces, access to play equipment, restroom facilities, fencing, and lighting.

This thesis found that only City Park provided accessible car parking, whereas Silesia Park, Azadi Park, and King Fahd Central Park were not accessible. None of the evaluated parks met all the required criteria for a fully accessible parking space. We found that Azadi Park and King Fahd Central Park had several issues, such as high curbs, narrow paths, and uneven surfaces, unlike City Park and Silesia Park. These issues create challenges for using mobility devices and safety risks. Irregular path surfaces are key obstacles in outdoor sports and physical activities for individuals with disabilities [33-35].

In City Park and Silesia Park, most play spaces have flat surfaces without steps from the orientation path to the play equipment, making the areas more accessible. However, in Azadi

Park and King Fahd Central Park, most play equipment lacks accessible walkways to ground-level components, making the play areas difficult for people with disabilities to use. In the evaluation of four public parks, we found that only City Park and Silesian Park provided fencing for play spaces. On the other hand, fences may unintentionally lower inclusiveness by limiting access points.

In this thesis, we found that King Fahd Central Park and City Park offer adequate lighting along circulation paths. Only the play areas in King Fahd Central Park and Azadi Park were equipped with adequate lighting. Nonetheless, the majority of Silesian Park and Azadi Park, along with their primary access routes, lacked lighting. Adequate lighting in multi-purpose areas such as tennis courts, basketball courts, skate parks, and playgrounds is recommended to facilitate evening activities for older children and adults [34].

We concluded that City Park exemplifies good practice in providing accessibility. But Silesia Park and King Fahd Central Park require improvement. Azadi Park demands a complete transformation to ensure accessible park and play spaces for all.

### **6.3 Limitations and suggestions for future research**

This section provides the following suggestions for future research to tackle the limitations, methodological challenges, and other key issues.

First, one of the aims of this study was to identify the critical aspects of physical characteristics in the built environment that impact the creation of sports cities for everyone in outdoor public spaces, with insights from professionals in the fields of architecture and urban planning. However, more research is needed to fully understand other important factors, such as personality traits within a group, psychological and sociological factors, cultural differences, and local climate. Further exploration of each aspect will assist policymakers in intervening in public spaces to create more accessible environments for all that enhance sports cities. This modification may encourage organising various sporting activities that benefit all members of the community.

Second, this study provided insights into the perceived physical features that hinder people with disabilities in running urban environments. However, further research is needed to examine how different physical attributes in public spaces, such as wayfinding elements, street furniture placement, and pavement materials, can contribute to the accessibility of the running experience. More research is needed to explore the experiences of disabled women to

understand the obstacles faced by disabled women, such as social factors and safety concerns, that help how policymakers and urban planners make gender-inclusive public spaces for running events. In addition, more research is needed to examine the role of technology and smart city solutions such as adaptive street lighting, real-time hazard reporting apps, and assistive navigation tools in improving accessibility for people with disabilities in the running experience. This can facilitate the establishment of optimal methods for creating universally accessible public spaces that promote street running for everyone.

Third, this study provided a significant evaluation of accessibility and usability in urban public parks for individuals with disabilities. However, more research is necessary to fully understand accessibility issues in a wider range of parks in different geographical areas. For instance, we need to examine diverse cultural and environmental contexts. People with disabilities need to be involved in designing and evaluating processes that can give us useful information about what makes parks accessible and what makes them inaccessible. We also need to look into how participatory design approaches can help make park planning more inclusive. Additionally, longitudinal research should explore how enhanced accessibility influences the participation of individuals with disabilities in outdoor leisure activities.

Future research is required to examine how technological innovation tools can enhance the safety and usability of parks and play spaces for individuals with disabilities. Furthermore, it is necessary to reevaluate current international accessibility standards by incorporating technological innovations and laws through the lens of robotic design. This needs cooperation with industrial designers to help people with disabilities further their independent mobility in a variety of outdoor recreational topographical spaces that accommodate all individuals [36-39].

Additionally, more policy research is needed to examine the effectiveness of existing international and national accessibility laws in promoting inclusive outdoor public spaces. Urban planners, local authorities, and people with disabilities can achieve this by working together to implement awareness standards.

## **6.4 Policy recommendations and practical implications**

This section presents recommendations and practical implications for practitioners, policymakers, and local authorities working in urban planning and design, as well as the aspects of disabilities and sports.

First, this thesis found the importance of spatial sports facilities for promoting and encouraging everyone in sports participation. Policymakers are always recommended to consider the accessibility and quality of spatial sports facilities in providing sports and physical activities to meet the needs of attracting everyone to participate in sports. This is important to reduce the obstacles that may motivate individuals with disabilities to participate. If participants encounter barriers, such interventions are required to adapt and enhance sports facilities in terms of the quality and access to the sports activities offered. Policies are necessary to improve the physical characteristics of sports facilities. This can be done by changing sports as a place for people to meet in cities and by making sure that everyone has an equal chance to get to outdoor sports facilities in neighbourhoods. As well as increasing sports inclusivity, the concept of sport for all should be acknowledged; it can address the barriers and needs in sports and recreation spaces for all people [10, 40, 41].

Second, this thesis found that attractive public spaces indicated a motivation for everyone to participate in sports activities. So, local authorities and practitioners need to prioritise the features that create attractiveness in the redesign of public spaces, such as green, blue, and lively ones. The key to encouraging everyone to participate in sports and physical activities is providing beneficial accessibility to the parks and natural areas. In addition, the revitalisation of open spaces based on flexibility and adaptability has enormous potential to help sports organisers organise various sporting activities and events that attract different groups of people to participate [24, 25, 41–43].

Third, this thesis confirms that organising and programming various sports activities plays an important role in motivating different social groups to participate in organised sports. In this regard, policies recommend involving and collaborating with stakeholders in organising sporting events, such as community sports coaches, managers, people in socially vulnerable positions, sports participants, and local authorities. This collaboration can increase the perception that it provides a safe space for all through sports and events, attracting those who do not yet participate. Furthermore, it is vital to avoid ticketed events and organise spaces for marketing and revenue generation [10, 21, 44–48].

Fourth, this thesis found that designing physical characteristics in-between buildings has positive and negative impacts on people with disabilities when organising street running. Urban practitioners needed to prioritise revitalising their physical characteristics by developing accessibility to remove all the impediments that may encourage more people with disabilities

to independently participate in street running. Urban practitioners should incorporate certain elements to enhance the accessibility and appeal of street running environments for individuals with disabilities. These include flat surfaces, the right placement of street elements, surfaces that don't slip, street connectivity, special rules (like tactile surfaces), lighting, and intriguing architecture.

Fifth, this thesis found that, in the case of the Activity Zone in Chorzow City, despite the revitalisation of recreational public spaces to create an inclusive environment for all individuals, some features remained neglected. However, the Activity Zone in Chorzow City still lacked certain features that were specifically designed for people with disabilities. Therefore, it is recommended that local authorities and practitioners be aware of applying principles of universal design and local accessibility standards (Warsaw Accessibility Standards) to revitalise public spaces. Additionally, there are practical recommendations for enhancing the case area that align with the Warsaw Accessibility Standards (Section 6, Page 170, 2022) for universally accessible outdoor recreation areas [49].

**Pathways:** It is essential to establish pathways that enhance the seamless connectivity of the Activity Zone with its surrounding areas, including residential zones, university buildings, and the main street. The following requirements are necessary for the accessible pathway design to adhere to the Warsaw Accessibility Standards: ensuring appropriate measurements, providing all necessary elements, and strategically locating them along the pathways to accommodate everyone. Ensure the pathways are obstacle-free by designing them with a minimum width of at least 1.8 meters. In order to allow two individuals with disabilities to pass each other freely, it is recommended to include local pedestrian extensions that are 2 meters wide and 2 meters long. These extensions should be positioned at a maximum distance of 20 to 25 meters, taking into consideration the pedestrian density. In addition, the surfaces of the pathways should be even, smooth, non-slip, and weather-resistant. They must be free from gaps, or in the case of having gaps, the width should not exceed 1 cm. Incorporate tactile surfaces in the centre of the pathways, ensuring their width is between 25 and 50 cm. These surfaces should exhibit textures, patterns, or colour contrasts to guide individuals with limited or no vision, enabling them to navigate and orient themselves independently.

**Street furniture:** The street furniture, including lighting elements, trash bins, and benches, should be located outside the width of the obstacle-free pathway, as specified in the outdoor recreation areas' accessibility standard section, with appropriate measurements.

**Establish ramps at the area's entrance.** The construction of ramps should ensure a smooth and seamless transition between different pavement surfaces, promoting independent and barrier-free movement for all individuals, including those with disabilities. The accessibility standard section in Chapter 3 mentions the dimensions of the ramp.

**Play equipment:** To create a level and even playing area for specific elements of the recreation areas, use rubber surfaces. This allows for smoother movement and makes the playing area accessible to all individuals, including those with disabilities.

**Toilets:** There are no toilets in the recreation area to encourage visitors to stay longer and enjoy their time. Therefore, it is important to establish accessible toilets for all. Meeting specific standards is necessary when designing accessible outdoor toilets to accommodate individuals with disabilities. The toilet compartment must have a minimum dimension of 2.2 x 2.2 m. It must provide a ramp for the entrance, and the level from the stairs outside the entrance and inside the toilet must be zero. Additionally, the width of the entrance door must be a minimum of at least 90 cm. The space in front of the toilet should be at least 1.5 x 1.5 m, free of devices and equipment, with a 30-40 cm space behind the toilet. Furthermore, there should be a transfer space to the toilet bowl from two sides of the toilet bowl with dimensions of at least 90 cm wide and 1.4 m long. We recommend a seat height of 45-48 cm and a minimum depth of 70 cm for the toilet bowl. The surface of the toilet must be smooth and non-slip, and an alert system must be in place.

**Parking areas:** There are two parking areas near the recreation space, but they are currently not visible to visitors. Therefore, adding parking signs for both areas can make them visible to all visitors, and it is also essential to establish continuous accessible pathways that lead people with disabilities to the recreation area.

Sixth, this thesis identifies the key areas (play equipment, path surfaces, restrooms, and car parking) within the design, environment, and safety of parks and play spaces that may hinder people with disabilities from participating in and enjoying activities. It highlights issues found in examples from these areas, including City Park in Hungary, Silesia Park in Poland, Azadi Park in Iraq, and King Fahd Central Park in Saudi Arabia. The areas recommended to enhance in each case are based on national standards (NZS 4121: 2001 and NZS 5828: 2004) and international guidelines.

**City Park** stands out as a positive example compared to other cases. However, continuity-providing tactile surfaces needed to be improved along the pathways, as well as parking spaces

that were far from the play spaces. These need to be considered, particularly for people with disabilities.

*Silesia Park* has noted weaknesses in its revitalised play spaces. Based on the accessibility standards applied to the evaluation, Silesia Park has identified several features that need improvement to create inclusive recreational public spaces for all users. These include the provision of accessible parking spaces, the improvement of public transit stops, which were located far from the play spaces, and the provision of restrooms near the areas. The existing restrooms are far away and do not meet the needs of people with disabilities. Furthermore, the provision of adequate lighting along pathways and for play areas was required.

*Azadi Park* faces significant accessibility challenges compared to other parks. The majority of features in Azadi Park were necessary to improve it. Existing uneven pathways, inadequate safety measures, poor lighting, limited access to play equipment, and inaccessible restroom and rest areas hindered the park's improvements. These issues excluded individuals with disabilities from participating in recreational activities. It is recommended that a redesign of the park and play spaces consider universal design principles and international accessibility standards to make inclusive environments and promote accessibility for everyone.

*King Fahd Central Park* also had critical accessibility issues. Consequently, many areas of the park must be enhanced, including the installation of accessible bus stops, improved transition ramps between parking spaces and pathways, level pathways with tactile guidelines, better access to play areas, accessible entrances to restrooms, and the need for universal restrooms. Therefore, these enhancements can foster accessibility and usability in King Fahd Central Park for all visitors.

In summary, inclusive design is essential for developing accessible and inviting public spaces. Although City Park exemplifies excellence, parks such as Silesia Park, King Fahd Central Park, and Azadi Park necessitate specific enhancements to guarantee equitable access. Involving individuals with disabilities in the planning and design process is crucial, as their perspectives contribute to the creation of parks that are accessible to all users. This approach is particularly crucial in areas like Iraq and Saudi Arabia, where accessibility obstacles remain dominant. By integrating varied viewpoints, local authorities can convert parks into inclusive environments that promote social cohesion and community involvement.

Seventh, despite the presence of national and international standards and the seven principles of universal design that make accessible outdoor public spaces. Urban designers still

struggle to completely plan and design public spaces and play areas that remain entirely accessible and usable for people with disabilities. This problem stems from diverse topographical circumstances and certain types of play equipment that are challenging for those with disabilities to utilise. In this sense, we recommend strong cooperation among urban designers, people with disabilities, and industrial and robotics designers, as well as compliance with international accessibility standards in designing robotics and play equipment that can meet the needs of people with disabilities, enabling them to move independently, overcome challenges in varied terrain, and use play equipment in recreational and leisure areas.

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