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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.

Keywords

Mass Street Running, Disability Runners, Accessibility Design, In-Between Buildings, Physical Barriers, Revitalization

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; Szaszák & Kecskés, 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-body street runners. However, without cars, the run-

ning 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.

2. Materials and Methods

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.

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	☐	☐	☐	☐	☐
Cyclists	☐	☐	☐	☐	☐
Cars	☐	☐	☐	☐	☐

Continued

Street signs	☐	☐	☐	☐	☐
Benches	☐	☐	☐	☐	☐
lighting	☐	☐	☐	☐	☐
Tress & green areas	☐	☐	☐	☐	☐
Trash receptacles	☐	☐	☐	☐	☐

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. Results

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

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

Variables	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	20.00	12.72	32.72
Cobblestones	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 running environment (%)			
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 running environment (%)			
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
Other elements	9.09	7.27	16.36
Physical barriers, mean			
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

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.

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.

Table 3 provides that there was no significant relationship between disabled runners and the importance of the running environment surfaces, χ^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.

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

Total (N = 110)	χ^2	df	*p*-value
110	0.031[a]	2	0.985

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,

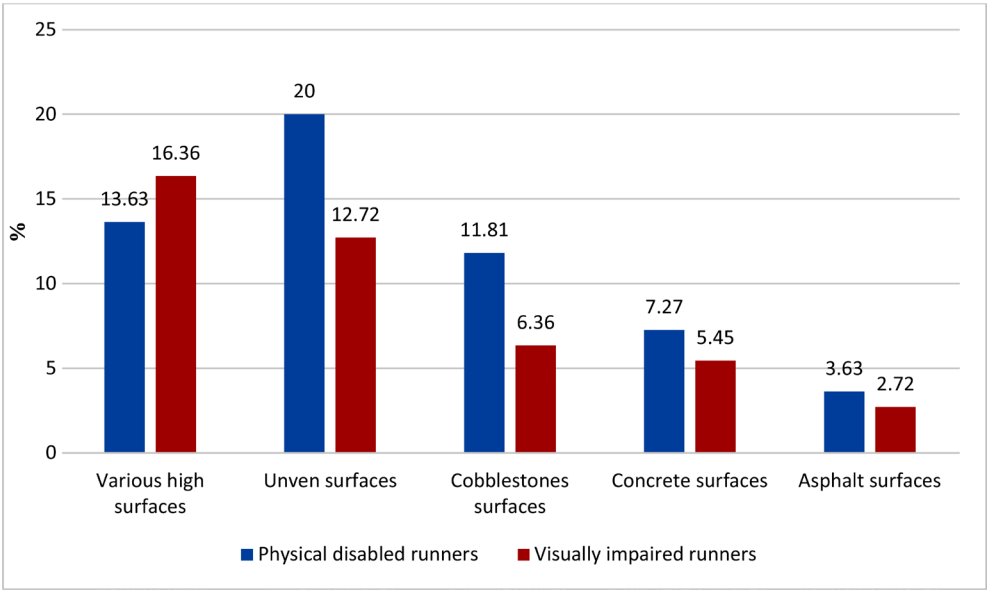

Figure 1. Distribution of respondents avoiding running surfaces for physically disabled and visually impaired runners.

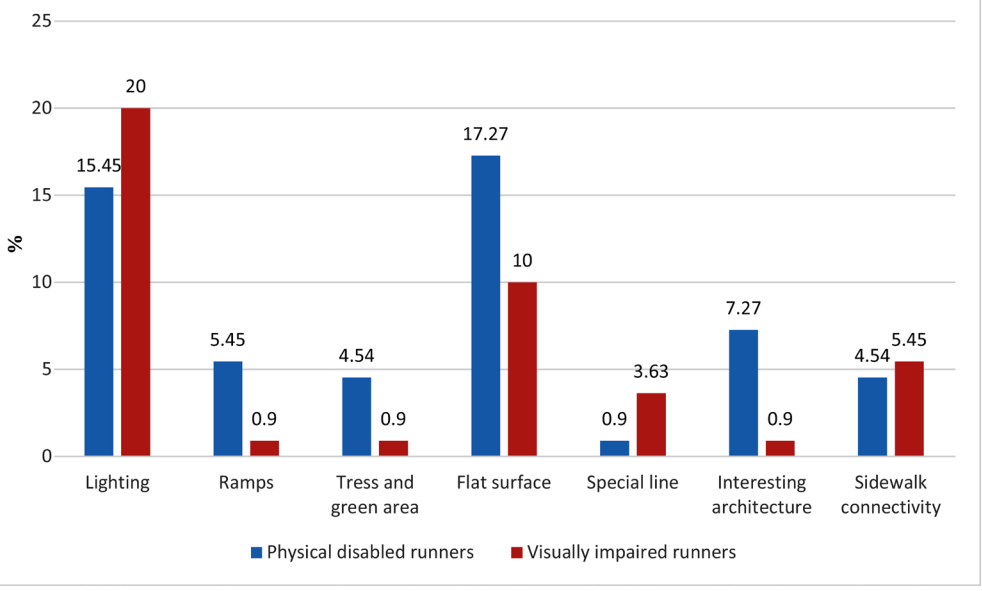

Figure 2. Distribution of respondents of the permanent street elements that positively influence the organization of running by physical disabled and visually impaired runners.

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 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.

3.4. 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 =

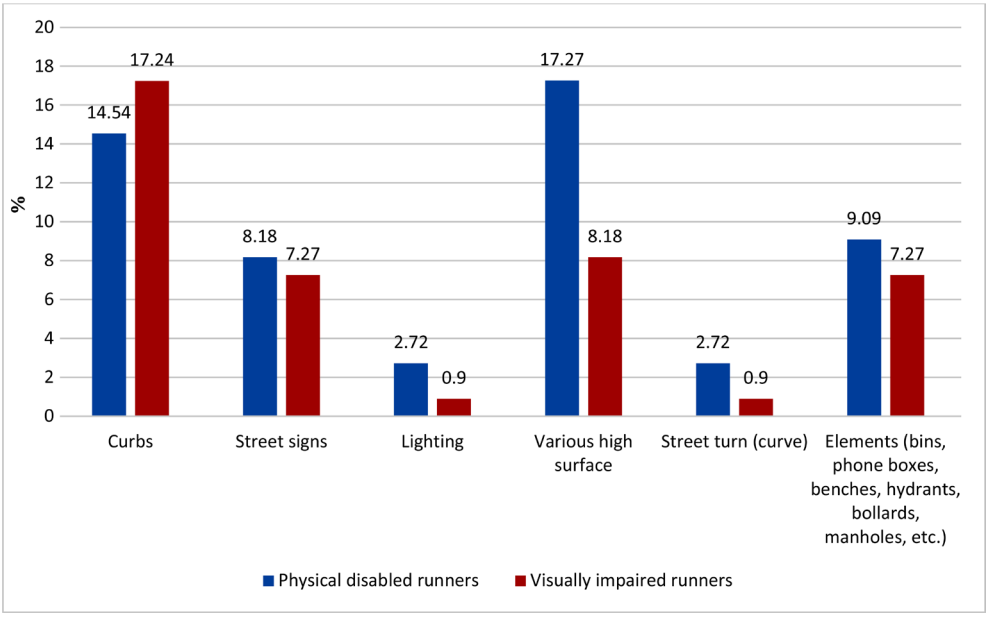

Figure 3. Distribution of respondents of the permanent street elements that negatively influence the organization of running by physical disabled and visually impaired runners.

1.23, and M = 3; SD = 1.20, respectively). 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 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, $p > 0.05$,

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

Variables	Physical and visually disabled runners	Mean	Std. Deviation	Std. Error Mean
Physical disabled runners	(N = 62; 56.36%)			
Curbs	62	3.39	1.178	0.150
Cyclists	62	3.24	1.126	0.143
Cars	62	3.18	1.337	0.170
Street signs	62	3.27	1.148	0.146
Benches	62	3.13	1.235	0.157
Lighting	62	3.34	1.241	0.158
Tress & green area	62	3.34	1.318	0.167
Trash receptacles	62	3.05	1.207	0.153
Visually disabled runners	(N = 48; 43.64%)			
Curbs	48	3.44	1.050	0.152
Cyclists	48	3.13	1.248	0.180
Cars	48	3.50	1.238	0.179
Street signs	48	3.44	1.183	0.171
Benches	48	2.96	1.211	0.175
Lighting	48	3.06	1.278	0.185
Tress & green area	48	3.17	1.358	0.196
Trash receptacles	48	2.96	1.148	0.166

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	Upper
Physical disabled runners						
Curbs	2.587	61	0.012	0.387	0.09	0.69
Cyclists	1.691	61	0.096	0.242	−0.04	0.53
Cars	1.045	61	0.300	0.177	−0.16	0.52
Street signs	1.881	61	0.065	0.274	−0.02	0.57
Benches	0.823	61	0.414	0.129	−0.18	0.44
Lighting	2.150	61	0.036	0.339	0.02	0.65
Tress & green area	2.024	61	0.047	0.339	0.00	0.67
Trash receptacles	0.316	61	0.753	0.048	−0.26	0.35
Visually disabled runners						
Curbs	2.887	47	0.006	0.438	0.13	0.74
Cyclists	0.694	47	0.491	0.125	−0.24	0.49
Cars	2.799	47	0.007	0.500	0.14	0.86
Street signs	2.561	47	0.014	0.438	0.09	0.78
Benches	−0.119	47	0.906	−0.021	−0.37	0.33
Lighting	0.339	47	0.736	0.063	−0.31	0.43
Tress & green area	0.850	47	0.399	0.167	−0.23	0.56
Trash receptacles	−0.252	47	0.803	−0.042	−0.37	0.29

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).

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.

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 rela-

tionship 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 Steutevile 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.

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.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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