

Paving the Way to Active Living for People with Disabilities:

Evaluating Park and Playground Accessibility and Usability in Delaware

Cora J. Firkin;¹ Lauren Rechner;² and Iva Obrusnikova, PhD, MSc³

1. Department of Health Behavior and Nutrition Sciences, University of Delaware

2. Epidemiology Program, University of Delaware

3. Department of Health Behavior and Nutrition Sciences, University of Delaware

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Abstract

Objectives: To evaluate the accessibility and usability of parks and playgrounds in New Castle County, Delaware, for people with disabilities, with a particular focus on identifying environmental barriers that may impede access to these public spaces and potentially affect physical activity (PA) participation for the chronic disease prevention and mitigation. **Methods:** Using a cross-sectional observational design, teams of trained University of Delaware students utilized the Community Health Inclusion Index (CHII) Tool to assess the accessibility of ten suburban and urban parks and playgrounds from April to November 2023. The tool evaluated various elements of public spaces, including public transit, parking, pathways and multi-use trails, entrances, playground equipment, and health promotional materials. Descriptive statistics were calculated for the accessibility and usability of each element. **Results:** Significant barriers to accessibility and usability were identified. Over half of the sites lacked nearby public transit stops, and many trails and playgrounds were not fully accessible to people with disabilities. While some areas demonstrated good accessibility, such as well-maintained pathways and appropriately designed crosswalks, barriers like uneven surfaces, insufficient curb cuts, and inadequate van-accessible parking spaces were common. Most playgrounds lacked equitable play equipment, with less than half having ground materials suitable for mobility devices. **Conclusions:** The study underscores the need for substantial improvements in the design, construction, and maintenance of Delaware parks and playgrounds to better support people with disabilities. Enhancing accessibility is crucial for promoting PA participation. The findings support the development of inclusive recreational and PA environments, aligning with the Americans with Disabilities Act, to reduce chronic disease health disparities faced by people with disabilities. **Policy Implications:** This study highlights the need for revised policy measures to enhance park accessibility, advocating for infrastructure improvements and inclusive designs to ensure equitable recreation and physical activity opportunities for people with disabilities.

Introduction

The World Health Organization's International Classification of Functioning, Disability, and Health (ICF) framework¹ posits that a person's level of functioning and disability, including their ability to participate, is influenced by the interaction of health conditions and contextual or

environmental factors, such as the accessibility of the environment, peer relationships, and the availability of services. Additionally, personal factors such as age, gender, values, and lifestyle also contribute to this dynamic. According to the Americans with Disabilities Act (ADA), passed in 1990 and amended in 2008, a person with a disability is defined as someone with a record of or is perceived to have a physical or mental impairment that substantially limits one or more major life activities, including bodily movements. In the United States (US), the 2023 Annual Disability Statistics Compendium reported that approximately 13.0% (42.6 million) of the community population live with a disability.² In Delaware, the percentage is slightly above the national count, with approximately 13.1% (nearly 130 thousand) of the population identified as living with a disability.² Notably, Delaware's disability-associated healthcare expenditures surged by 93% in 2015, reaching 3.1 billion USD, a significant increase from 2013.³

Persistent health disparities are often faced by people with disabilities, including substantially increased risk of poor overall health status^{4,5} and population-level differences in preventable health conditions *not* predominantly attributed to the underlying impairment.⁶ National datasets from the US indicate that people with disabilities have significantly higher prevalence rates of chronic diseases than people without disabilities, including arthritis, asthma, cardiovascular disease, diabetes, high blood pressure, high cholesterol, and stroke.^{5,7} Evidence also supports that people with a disability have significantly higher body mass index than people without disability.^{5,7} Nevertheless, people with disability are often an overlooked population in national public health initiatives to address chronic disease.⁶

In Delaware, these chronic diseases – cerebrovascular disease, diabetes mellitus, and heart disease – jointly accounted for about 30% of deaths across all ages in 2018.⁸ For children and adolescents, non-congenital heart diseases accounted for 3.3% of deaths in those aged 1 to 4 years and 6.1% of deaths in those aged 5 to 14.⁸ In addition, there is a marked discrepancy in obesity prevalence between Delawareans with a disability (45%) and Delawareans without a disability (30.2%), resulting in a +14.8% gap, which exceeds the national statistic of a +11.8% gap between people with and without a disability.² Consequently, chronic disease prevention and mitigation is of utmost importance to Delaware, with the Delaware Division of Public Health (DE DPH) supporting the vision of “healthy people in healthy communities.”⁹

To achieve this vision, physical activity (PA) is an important modifiable health behavior for reducing the risks of high body mass index and chronic diseases.¹⁰ A major domain of PA is leisure, occurring during one's free time and includes physical recreation for enjoyment, structured exercise to improve or maintain physical fitness, or sports, often involving team participation and rules or expectations. To achieve health benefits, the 2018 *Physical Activity Guidelines for Americans* recommend that adults with disabilities, if capable, participate in at least two days of moderate-to-vigorous muscle-strengthening activities targeting all major muscle groups. Additionally, they should aim for 150-300 minutes of moderate-intensity or 75-150 minutes of vigorous-intensity aerobic PA each week, or an equivalent combination. For children and adolescents, regardless of disability status, the guidelines suggest at least 60 minutes of moderate-to-vigorous PA daily.¹¹ However, people with disabilities are less likely to participate in any physical activity^{4,12} and are often less likely to adhere to the PA guidelines, resulting in higher rates of health issues related to physical inactivity than their peers without disabilities.¹³

Creating and maintaining community-built environments to promote PA, particularly leisure PA, is recommended by the 2018 *Physical Activity Guidelines for Americans* to offset the rise of

chronic disease¹¹ and is a strategic effort highlighted by the DE DPH.⁹ However, a persistent public health challenge lies in creating environments that effectively promote PA, particularly when taking into account the variations in individual differences, such as impairments, health conditions, and age.¹⁴ Recent studies have begun identifying the environmental quality indicators associated with increased PA (e.g., green spaces, intersection density, street connectivity, park proximity, ‘walkability’).^{15,16} Despite these advancements, there remains an urgent need to ensure that these environments are universally accessible to everyone. The ADA Accessibility Guidelines (ADAAG), originally mandated in 1991 and amended through September 2022, provide scoping and technical standards for the design, construction, and alteration of buildings and facilities. These ADAAG guidelines aim to ensure accessibility for people with disabilities in areas covered by Titles II (public entities and public transportation) and III (public accommodations and commercial facilities) of the ADA.¹⁷ Nonetheless, the inaccessibility of built and natural environments continues to be a major barrier to PA participation by people with disabilities,^{18,19} emphasizing the perception that natural environments are ‘inherently inaccessible.’¹⁸

Public parks and play areas, such as playgrounds, integrate elements of built and natural environments. The ADA mandates stipulate that these spaces must offer continuous and unobstructed accessible routes, including maneuvering spaces and ground-level and elevated play components. Recent studies indicate that park-based interventions can substantially improve physical, psychological, and social health outcomes in people with a disability, mitigating disability-related impairments and chronic health disparities.²⁰ For children and adults without a disability, a systematic review has also shown improvements to park and play area environments, such as installing exercise and playground equipment and renovating surfaces and lighting, are likely to increase their PA participation.²¹ However, as of September 2022, Section 15 of the ADAAG on Recreation Facilities,¹⁷ which incorporates key aspects of play areas, such as play and exercise equipment, accessible surfacing materials, and accessible play area routes, has not been integrated into the Department of Justice Accessibility Standards, rendering it non-enforceable. This regulatory gap is further widened as playground facilities built before March 15, 2012, are not mandated to comply with the 2010 ADA Standards for Accessible Design. Such inconsistencies in compliance potentially lead to varied accessibility in play areas for people with disabilities. Addressing these health disparities at the community level begins with a thorough assessment of the accessibility and usability of existing play areas to promote PA in people with disabilities.

The purpose of this research study is to evaluate the accessibility and usability of parks and playgrounds in New Castle County, Delaware, for people with disabilities. Employing the Community Health Inclusion Index (CHII) Tool, this research aims to comprehensively assess various aspects of these public spaces, including public transit, intersections, parking, pathways, entrances, health promotional materials, restrooms, playgrounds, trails, and other elements impacting navigational supports and barriers. This study primarily focuses on identifying key environmental barriers that may impede access to public spaces for people with disabilities. While not directly measuring the impact of these barriers on PA participation, the study recognizes the importance of accessible environments in promoting PA among all community members, including those with disabilities. The research outcomes will offer targeted recommendations for improving the accessibility and usability of these community spaces. Ultimately, this study aims to contribute to the broader objective of fostering inclusive public

spaces that encourage active living and help mitigate the risk of chronic diseases in people, including those with disabilities.

Method

Parks and Playgrounds

Using a cross-sectional observational design, the study collected data from ten parks and associated playgrounds in New Castle County, Delaware, the state's most populous county, with particular emphasis on Newark and Wilmington. These sites, spanning seven different zip codes, were selected to represent a diverse range of suburban and urban public spaces, ensuring a sample reflective of the broader state and county demographics (Table 1). The inclusion criteria stipulated that the play areas must be outdoor, publicly accessible, and equipped with play components designed for play, socialization, or learning. Parks and associated playgrounds that required admission or parking fees were excluded from the study. The key determinant in selecting these sites was their community relevance, ensuring that the study's insights would be meaningful across various suburban and urban contexts. Although convenience played a role in the selection process, this strategic approach ensured that the study's findings effectively contributed to the broader discourse on public space accessibility. The characteristics of the included parks and playgrounds can be found in Table 2.

Table 1. Delaware and New Castle County Characteristics from the 2022 American Community Survey

Population-Level Characteristic Estimate ± Margin of Error	Delaware	New Castle County
N (% with a Disability)	1,005,551±962 (13.8±0.8)	568,914±312 (11.9±0.9)
<i>Median Age (years)</i>	41.5±0.3	39.8±0.5
With a disability under 18 years	9,979±2,065	5,215±1,595
With a disability 18-64 years	66,104±5,2066	34,451±3,499
With a disability 65+ years	63,051±3,695	28,093±2,581
<i>Sex (% with a Disability)</i>		
Females	519,710±1,165 (14.0±0.9)	293,320±497 (12.3±1.3)
Males	485,841±1,475 (13.6±1.1)	275,594±533 (11.5±1.2)
<i>Race / Ethnicity (% with a Disability)</i>		
Asian alone ^a	41,396±1,750 (6.0±1.7)	34,143±1,360 (4.8±1.5)
Black/African American alone ^a	220,524±4,731 (14.1±1.9)	144,739±3,535 (13.2±1.8)
White alone ^a	603,201±4,199 (15.0±0.9)	309,249±2,855 (12.8±1.2)
Two or more races ^a	96,968±6,106 (11.8±2.0)	52,209±5,298 (9.5±2.5)
Hispanic/Latino (of any race)	104,293±621 (8.7±1.8)	64,937±191 (8.6±2.3)
<i>Household Income</i>		
Median (USD)	82,174±2,002	86,010±4,378
Mean (USD)	105,438±2,965	109,393±4,213
<i>% Below Poverty Level</i>	9.4±0.9	9.6±1.2

Note. Total population, sex, and race/ethnicity came from S1810; median age from S0101; age by disability status from K201801; household income from S1901; and poverty level from S1701. ^a may or may not have identified as Hispanic or Latino

Table 2. Characteristics of the Parks with the Included Play Areas from Assessment using the Community Health Inclusion Index (CHII) Tool from April to November 2023.

ID	Park Name (Inaugural Year)	Size (acres)	Physical Activity-Related Amenities	Address
1	Glasgow Regional Park (NR – 2016 for the High 5 Sensory Playground)	250	Basketball Courts, High 5 Sensory Playground [†] , Playground, Tennis Courts, Trails/Paths	2275 Pulaski Hwy, Newark, DE 19702
2	Kells Park (NR)	5.2	Baseball / Softball Field, Basketball Courts, Playground, Soccer Field, Tennis Practice Wall, Trails/Paths	201 Kells Ave., Newark, DE 19711
3	Hillside Park (2021)	7	Natural Play Area, Playground, Trails/Paths	103 Hillside Rd., Newark, DE 19711
4	Paper Mill Park (NR)	NR	Basketball Courts, Soccer Field, Playground, Tennis Courts, Trails/Paths	1050 Paper Mill Rd., Newark, DE 19711
5	Preston’s Playground (2018)	0.07	‘All-Inclusive’ Playground	250 Old Paper Mill Rd., Newark, DE 19711
6	New Castle Battery Park (NR – 2023 for Playground)	NR	Playground, Trails/Paths	1 Delaware St., New Castle, DE 19720
7	Brandywine Springs Park (NR)	62.35	Baseball / Softball Field, Basketball Court, Playground, Trails/Paths, Volleyball	3302 Faulkland Rd., Wilmington, DE 19803
8	Banning Regional Park (NR)	NR	Baseball / Softball Field, Fitness Circuit, Playground, Soccer Field, Tennis Court, Track, Trails/Paths, Volleyball	102 Middleboro Rd. Wilmington, DE 19804
9	Canby Park (1916)	43.5	Baseball Fields, Basketball Courts, Football Field, Playground, Tennis Courts, Trails/Paths	901 S. Clayton St., Wilmington, DE 19805
10	Cool Springs Park (1862)	14.7	Playground, Trails/Paths	1001 N Van Buren St., Wilmington, DE 19806

Note. NR = not reported on park website or cannot be determined [†] Delaware’s first playground designed for children with autism spectrum disorder.

Instrumentation

The Community Health Inclusion Index (CHII) Tool, a validated instrument, is designed to assess the inclusivity of community health resources for individuals with disabilities.²² This tool encompasses an on-site assessment survey tailored to evaluate the accessibility of built

environments in various community settings, including parks and playgrounds. The CHII survey methodically examines the navigability and usability of these sites for people with disabilities, focusing on identifying potential barriers and facilitators to accessibility. The tool comprehensively evaluates external factors such as sidewalks, parking, intersections, and public transportation stops, providing insights into the overall accessibility of facilities. Additionally, it explores internal environmental elements, including health promotion materials, restrooms, and playground equipment, to assess their suitability for individuals with disabilities. The survey utilizes a mix of question types—yes/no, multiple-selection, and a four-point Likert scale ranging from *none* to *all*. The CHII Tool's reliability and validity have been rigorously tested across 164 sites in five states. This testing has confirmed its efficacy, as indicated by high inter-rater agreement and strong Cronbach's alpha coefficients ranging from 0.70 to 0.97. Such robust validation underlines the CHII Tool's suitability and effectiveness for use in this study.

Procedures

Data collection for this study was conducted from April to November 2023, involving two teams, each comprising two University of Delaware students. These students were either undergraduates in their junior or senior year who had previously completed an Introductory Adapted Physical Activity course or graduate students from the College of Health Sciences who had not taken this course but pursued relevant coursework. This background provided a foundational understanding of disability and how to adapt environments to promote full participation in PA. Prior to the assessments, the students underwent comprehensive instruction and training in the CHII protocol to ensure accuracy and consistency in their evaluations. Post-training, each team was assigned a specific park and given a 14-day window to conduct the full CHII observational audit. This process involved independently evaluating the park's accessibility and usability features, guided by the official CHII instrument. For the observational audits, the teams were equipped with standard rulers and smart tools for measuring slopes in accordance with the ADAAG. These tools ensured precise and standardized data collection across all sites. Following the on-site evaluations, the students recorded their data into a central spreadsheet. This submission included detailed supporting information for each aspect of the park's evaluation, ensuring a comprehensive data set for analysis.

Data Analysis

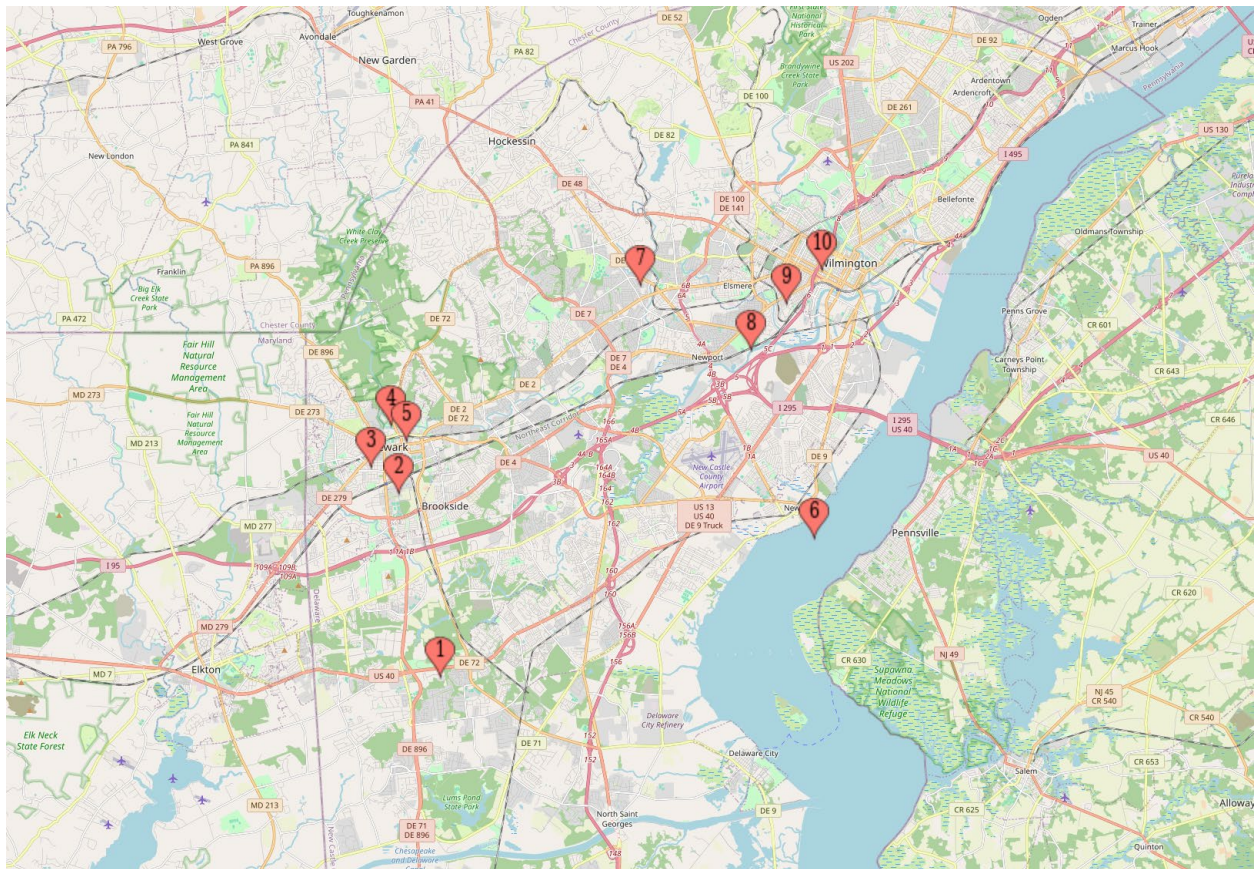
Initially, the collected data underwent a quality check conducted by the first and third authors (L.R. and I.O.) to ensure the dataset's integrity and readiness for in-depth analysis. Once verified, the data were compiled into a cohesive dataset and then exported to the SPSS statistical software package (IBM Corp. Released 2023. IBM SPSS Statistics for Mac, Version 29.0.1. Armonk, NY: IBM Corp) for further analysis. Descriptive statistical methods were employed to summarize the data. Cronbach's alpha coefficients were calculated to evaluate the reliability of the CHII. The range of these coefficients, from .69 to .99, indicated varying degrees of internal consistency across different subscales, with the lowest scores for walking support and promotional materials. Additionally, inter-rater agreement was calculated to assess the consistency of the rating conducted between the two teams, each comprising two students, across all evaluated sites. The results showed strong agreement for most parks, indicating a high level of consistency in the data collection process by the different raters.

Results

Characteristics of Zip Code Areas

The ten play areas in New Castle County were distributed across various zip code areas, with one each in 19702, 19720, 19803, 19804, 19805, and 19806, and four in 19711, as shown in Figure 1. Collectively, these zip codes have an approximate population of 253,581 (range: 9,898-59,679). Notably, around 13% of the population across these areas are people with disabilities (range: 8.7-15.1%). The distribution of disability is almost equal between females (12.4%) and males (13.2%). Breaking down by age groups, the data show approximately 3,215 children and adolescents under 18 years, 16,016 adults aged 18 to 64, and 11,661 adults aged 65 and older have a disability. Racial and ethnic composition in these areas includes about 12,119 individuals identifying as Asian alone, 66,952 as Black or African American alone, 142,125 as White alone, and 17,618 as two or more races. In addition, there are 35,633 individuals identified as Hispanic or Latino of any race. Economic factors vary across these zip codes, with the estimated median and mean household incomes ranging from \$55,912 to \$122,853 and \$71,418 to \$175,462, respectively. The percentage of people living below the poverty level in these areas ranges from 3.6% to 22.0%.

Figure 1. 2023 Park locations across New Castle County, Delaware



Note: (1) Glasgow, (2) Kells, (3) Hillside, (4) Paper Mill, (5) Preston's Playground, (6) New Castle Battery, (7) Brandywine Springs, (8) Banning, (9) Canby, and (10) Cool Spring.

Park Characteristics

The management of these ten sites is split between the City of Newark (Parks 1-5), New Castle County (Parks 6-9), and the City of Wilmington (Park 10), indicating varied stewardship by local government entities. This diverse stewardship is reflected in the physical attributes of each site, which vary considerably in size (range: 0.07-250 total acres), types of playground equipment, availability of sport and recreation fields and courts (e.g., baseball and softball fields, basketball courts, soccer fields, tennis courts), the extent of green spaces, and the presence of trails and pathways (see Table 2). Preliminary observations highlight variations in accessibility features at these sites, including available parking spaces, presence of key facilities such as restrooms and benches, and maintenance of trail and pathway conditions. According to information available on their official websites, these parks and playgrounds serve as popular spots for residents, utilized for leisure PA, recreation, exercise, sporting events, and other community gatherings, thereby playing an important role in the daily lives of the community members. However, it's important to note that our study did not directly assess the actual number of residents using these parks at the time of assessment. Therefore, while the websites provide a sense of the parks' intended use and the range of activities they can accommodate, they do not offer specific data on usage frequency or popularity among residents.

Public Transit Availability and Accessibility

In evaluating public transit near ten park and playground sites, the study identified notable accessibility gaps for people with disabilities. Only six sites (60%) had nearby transit stops (i.e., bus, train, and other fixed route stops within a few blocks—up to a ¼ mile—from the site). During peak hours, transit frequency varied: services were available every 15 minutes or less at one site (17%), at 16-30-minute intervals at another site (17%), and at intervals exceeding 30 minutes at four sites (67%). During off-peak hours, transit services were within 30 minutes at one site (17%), 31-60 minutes at three sites (50%), and over 60 minutes at two sites (33%). Among the six sites with nearby transit stops, two (33%) were served by public transit vehicles equipped with level boarding options, such as ramps or lowered vehicles, and auditory announcements. All six sites had stops with visual displays. Transit-stop amenities varied: three stops (50%) had shelters, and five (83%) provided features such as signage with Text-To-Voice numbers, benches, seating, and space for maneuvering mobility devices. However, stable and firm landing pads were found at only two stops (33%), and sufficient lighting was found at four stops (67%).

Pathway Supports and Barriers

The assessment of pathway supports and barriers at the ten sites revealed various accessibility features. Researchers uniformly rated all sites as safe for walking or rolling on paths. Six sites (60%) had some buffer between sidewalks and streets, such as landscaping or parking lanes, while four sites (40%) featured more extensive buffers. In terms of amenities, five sites (50%) were noted for their ample benches or seating options, although one site lacked these entirely. Trees or shade, conducive to pleasant PA-promoting environments, were abundant in eight sites (80%), with two sites (20%) having extensive green spaces.

Pathway conditions varied; four sites (40%) were rated as having thoroughly clean and well-maintained pathways, three (30%) were observed to have many clean paths, and three (30%) had some. Noise pollution was rated as generally moderate, with seven sites (70%) rated as having

some noise and only one site (10%) rated as entirely free from noise pollution. The researchers infrequently observed loitering, with six sites (60%) having no related issues and eight (80%) being graffiti-free. However, seven sites rated litter as a prevalent issue (70%).

Curb cuts, which are sloped transitions between the sidewalk and street level designed to facilitate access for individuals using wheelchairs or with mobility impairments, were deemed necessary by the researchers at five sites (50%). Six sites (60%) had curb cuts with an appropriate slope, and eight (80%) were rated free of barriers. However, complete freedom from surface breaks at curb cuts was found only at one site (10%), and two sites (20%) did not have detectable warnings in good condition.

Intersections Accessibility

The assessment of intersection accessibility across the ten sites yielded mixed results. All crossings near these sites were well-marked with stripes, paint, or bricks, demonstrating a consideration for pedestrian safety. Researchers found that seven sites (70%) had all crossings clear of obstacles or hazards, two sites (20%) had many clear crossings, and one site (10%) had some. Regarding wheelchair accessibility, curb cuts were present at both ends of crossings in eight sites (80%) and partially in two sites (20%), indicating room for improvement. Auditory crossing signals were present at three intersections (30%) near the parks, enhancing accessibility for pedestrians with visual impairments. Visual countdowns, essential for those with hearing impairments, were observed at five intersections (50%). Nonetheless, only two sites (20%) were noted to have crossing signals that provide sufficient crossing time for pedestrians with slower mobility.

Parking Availability and Accessibility

Of the ten parks and playgrounds surveyed, nine (90%) were found to have parking lots, indicating a high level of vehicular accessibility. Of the nine sites with parking lots, eight (89%) prominently displayed the International Symbol of Accessibility in their parking spaces, indicating a commitment to inclusivity. Furthermore, all nine parking lots provided access aisles of at least five feet in width adjacent to the accessible parking spots, enhancing overall usability. Notably, seven sites (78%) included designated van-accessible parking spaces, explicitly accommodating visitors who use larger mobility aids.

Entrance Accessibility

In evaluating the entrances at the ten park and playground sites, it was observed that all sites (100%) were free of stairs and doors at the main entrances, facilitating unobstructed access for individuals with mobility challenges, including those using manual or electric wheelchairs, canes, crutches, or other assistive devices. This uniform absence of staircases and doors rendered additional features, such as ramps, lifts, and separate accessible entrances, unnecessary. Consequently, elements like power assist, automatic doors, and other potential entrance barriers were also not applicable. This approach to eliminating common physical barriers demonstrates a strong commitment to ensuring the initial accessibility and inclusivity for all visitors to these recreational and PA-promoting areas.

Health Promotional Materials

The assessment of the availability of health promotional materials at the park and playground sites revealed a significant shortfall in accessible material formats. None of the sites provided promotional materials for PA or nutrition education programs in an electronically accessible plain text format, which includes text descriptions of pictures. This omission of digitally accessible information could potentially restrict the accessibility of health promotion efforts, primarily affecting those who rely on digital formats. Furthermore, eight sites (80%) did not provide promotional materials in large print, which is crucial for individuals with visual impairments, with only two sites (20%) accommodating this need. The study also noted a lack of pictograms, a format beneficial for individuals with intellectual and developmental disabilities, such as autism, in eight sites (80%). Only two sites (20%) incorporated such materials. These findings point to a pressing need for more inclusive and diverse formats in health promotional materials at these recreational spaces.

Restrooms Availability and Accessibility

The assessment of restroom facilities revealed both strengths and areas needing improvement. Eight sites (80%) had restroom facilities, which is critical for visitor comfort. However, a notable gap was the absence of automatic doors or open corridor entrances in the restroom, which could impede accessibility for individuals with mobility impairments. The researchers rated door operability as generally good, with seven of the eight restrooms (88%) requiring minimal force to open. Nevertheless, only five (63%) featured door handles operable with a closed fist (i.e., without the necessity for pinching, grasping, or twisting the wrist), indicating a need for improvement in this area. The door opening width met accessibility standards (at least 32 inches) in seven restrooms (88%), accommodating users with mobility aids. Stall features varied: door handles and latches operable with a closed fist were present in four restrooms (50%), and grab bars, essential for safety, were available in seven (88%). Additionally, six restrooms (75%) offered adequate space within stalls for mobility devices, suggesting a general accommodation for diverse mobility needs.

Playgrounds and Multi-use Trails Accessibility

An examination of playgrounds and multi-use trails at ten parks and playground sites revealed various accessibility features. Concerningly, only half (5 out of 10, 50%) of the playgrounds offered ground material suitable for mobility devices, such as poured-in plastic rubber, pointing to a need for universally accessible surfaces. Ground-level play components were more commonly available, present in seven playgrounds (70%). However, the accessibility of elevated play components was less common, with only four playgrounds (40%) featuring ramps or transfer equipment, limiting accessibility for children with mobility impairments. In contrast, the multi-use trails demonstrated a commendable level of accessibility. All surveyed trails featured benches, rest areas, and firm, smooth surfaces essential for safe navigation with mobility devices. These trails' design also included a minimum width of five feet and an absence of obstacles, highlighting their accessible design and maintenance.

Discussion

This research study conducted a comprehensive assessment of the accessibility of parks and playgrounds in New Castle County, Delaware, with a particular focus on identifying their

usability for people with disabilities. Utilizing the Community Health Inclusion Index (CHII) Tool, the study thoroughly evaluated various aspects of these public spaces. The findings illuminate the current state of these natural and built environments, highlighting the accessibility, availability, and functionality of essential amenities central to fostering inclusive experiences. Importantly, the study considers the broader context of chronic disease prevention and mitigation, recognizing the significant health disparities faced by Delawareans with disabilities. Historically, people with disabilities have been inadequately represented in the planning, development, and maintenance of spaces that promote recreation and PA. By identifying existing gaps in accessibility, this research aims to advocate for equitable access and active participation in recreational and PA environments. Such efforts are vital not only for directly including people with disabilities in chronic disease prevention initiatives but also for promoting health, well-being, and overall quality of life for the entire community.

A key finding in this study is the limited availability and frequency of public transit services near parks and playgrounds, particularly during peak hours. This situation presents a barrier for nearly half of people with disabilities, impeding their ability to reach destinations in a timely manner²³ and consequently reducing their opportunities for leisure PA. This finding underscores the crucial role of transit infrastructure in promoting PA participation.^{21,24} Enhancing public transit services, such as constructing new stops closer to park and playground entrances, adding shelters, and enhancing accessible features like platform gaps and lighting, could substantially increase PA among people with disabilities.^{21,25} Furthermore, the lack of essential accessibility features on public transit vehicles, such as auditory announcements and assistance mechanisms, presents challenges, particularly for people with vision^{23,26} or mobility²³ impairments. In urban areas like Newark and Wilmington, issues like unannounced stops and overcrowded vehicles are more frequent compared to suburban or rural areas.²³ Effective solutions include integrating vehicle modifications and assistive technology. As suggested by Bezyak et al.,²³ equipping public transit vehicles with auditory stop announcements and text alerts can aid passengers with auditory disabilities. Developing personal assistive applications with GPS capabilities can enhance route planning and provide essential travel information, thereby improving navigation and accessibility. These improvements are crucial for facilitating safe and convenient access for people with disabilities and enhancing the universal appeal and usability of public parks and playgrounds.

In addressing availability and accessibility for those who do not use public transportation, our study identified a notable gap in the availability of van-accessible parking spaces despite most sites offering parking lots with accessible features. This barrier is not unique to our study's sites but is a widespread concern in both indoor community fitness and recreational facilities¹⁸ and outdoor areas across the US²⁵ and internationally.^{27,28} Notably, Perry et al.²⁷ reported that less than a third of the 21 parks they evaluated had adequate, accessible parking spaces, often falling short in the dimension of aisles. Rosenberg et al. echoed these findings, noting barriers such as limited aisles space for vehicle access, a scarcity of available, accessible parking spots, distant placement of accessible parking from park entrances, and a lack of accessible routes within parking lots.²⁵ Addressing these by ensuring the availability of van-accessible parking spaces is imperative for equitable access to recreation and PA.²⁵ Furthermore, the study emphasizes the need for enhanced intersection accessibility near recreational areas, citing the safety concerns due to the absence of traffic control devices and adequate auditory and visual signals at crossings. Although the present study observed positive aspects such as stair-free park and

playground entrances, effective accessibility planning must consider all aspects of transportation and navigation from the point of entering parks and playgrounds.

Inside the parks, the present study highlighted the critical role of well-maintained pathways, appropriately designed and constructed curb cuts, and accessible parking in facilitating inclusive routes for PA, such as jogging, running, rolling, and walking. Regular maintenance of pathways to ensure level and even surfaces, effective litter management, and strategic curb-cut construction are essential for ensuring safety and ease of navigation, particularly for people with visual or mobility impairments. In a nationwide analysis of 401 local public entities, only nine reported the accessibility of curb cuts and sidewalks, of which only 35% of curb cuts and 52% of sidewalks were accessible.²⁹ The findings of the present study mirror this national shortfall, with only one park (10%) meeting all curb-cut accessibility standards. Once on pathways, the researchers in this study consistently rated all sites as safe for walking or rolling. This finding contradicts recent findings for people with mobility impairments in urban parks and forests, who noted difficulties with uneven gravel surfaces, especially after unfavorable weather.^{25,28,30} Pathways composed of aggregate materials may provide suitable access to parks for people with mobility impairments and use wheelchairs.³⁰

In this study, all multi-use trails were found to be smooth, unobstructed, and wide, contrasting with the findings of Perry et al.,²⁷ reported limited availability of sites with adequately wide paths (about 5 feet). A key opportunity identified in this study is the enhancement of trail accessibility, particularly benefiting users with visual, cognitive, or mobility impairments. In another study, in-depth interviews with people with disabilities highlighted the need for navigational aids throughout parks, particularly in larger ones and those with varied terrain and distances between facilities. In addition, providing information about the park layouts near park entrances can significantly assist in navigation and accessibility.²⁸ In addition, these participants revealed difficulties with navigating large parks (greater than 180 acres), particularly with layouts that considerably separate facilities.²⁸ With park sizes in this study ranging from 0.07 to 250 acres, the addition of navigational aids providing relevant information about trail conditions, especially in larger parks, can be particularly meaningful in boosting the usability of these spaces. Furthermore, integrating features compatible with wayfinding technologies³¹ or adapting existing signages to include pictograms, visual aids, and interactive tactile elements could facilitate independent and safe navigation throughout the park, especially for people with visual or cognitive impairments. This approach can expand opportunities for PA across the entire park, making these spaces more accessible and usable.

The study's examination of multi-use trails indicated significant progress in accessibility. Yet, it identified a pressing need for more comprehensive enhancements in playground designs to fully support people with disabilities. Among the ten playgrounds evaluated, only Glasgow Regional Park's High 5 Sensory Playground, tailored for children and adolescents with autism, and Preston's All-Inclusive Playground were specially designed to meet the needs of people with disabilities. These playgrounds exemplified inclusive design, with universally accessible ground materials, ramps, or transfer systems for accessing elevated play structures and various ground-level play elements. Consistent with existing research,²⁷ only four of the playgrounds (40%) in the study incorporated transfer systems that seamlessly connected ground-level and elevated play components, accommodating children and adolescents with mobility impairments. Park renovations, such as the expansion of play areas or the addition of new elements, known to increase PA participation in children and adults, particularly in low-household-income areas,³²

are crucial. Implementing such inclusive design enhancements, which align with established accessibility standards, serves to enhance the overall experience and enjoyment of parks and playgrounds for community members of all ages and abilities.

Another key finding of this study is the lack of diverse and accessible formats in health promotional materials. Notably, none of the evaluated sites used electronic American Standard Code for Information Interchange (ASCII) formats, and most lacked large print or pictogram options. This oversight is significant, especially since a 2018 study indicated that most cardiovascular disease health promotion programs in Delaware did not adequately serve people with disabilities.³³ Enhancing the reach and inclusivity of these programs is essential. Therefore, adopting more inclusive strategies for creating and distributing these materials in person and on park websites is crucial to ensure they are accessible and relevant to a broad audience, including those with disabilities. A 2022 study reinforces this need, with 93% of participants with disabilities expressing a desire for accessible information about events in local parks.²⁸ Events in Delaware parks, ranging from social and cultural gatherings to PA-related activities, such as sports games, practices, camps, walks, 5K races, and outdoor group fitness classes, offer community members holistic opportunities to improve their biopsychosocial health outcomes and engage in active lifestyles.^{20,33}

Drawing upon comprehensive research, including an extensive 2018 review,³⁴ this study contributes valuable insights into how improved accessibility in public transportation, parks, and playgrounds can potentially promote PA participation for all community members. It echoes the key principles of the WHO's ICF framework,¹ emphasizing the implicit influences of accessible environments in determining the functioning and PA participation of people with disabilities. Consistent with the ADA, Delaware Division of Public Health,⁸ and the *2018 Physical Activity Guidelines for Americans*,¹¹ this research highlights the urgent need to surpass mere compliance with legal accessibility standards. Instead, it calls for the proactive design and construction of community spaces that promote PA and contribute to chronic disease prevention. The findings in the present study align with the global objective of building inclusive communities, emphasizing equitable access to health-promoting activities. This is particularly vital for people with disabilities, who may face compounded disparities across additional personal determinants,³⁵ such as gender, race, ethnicity, or income. For example, additional public transportation barriers are faced by people with disabilities who identify as female or Hispanic/Latino or who are around the poverty level.²⁶ To fully achieve the vision of "healthy people in healthy communities,"⁸ we advocate for collaborative design and maintenance strategies that embrace diverse cultural perspectives. This approach will ensure meaningful and cost-effective improvements in the accessibility and usability of parks and playgrounds for all community members.

Moreover, this study uncovers a regulatory gap: the ADAAG are not being fully implemented in some recreational sites in New Castle County. This gap points to inconsistencies in ensuring accessible play areas for people with disabilities and underscores the necessity of rigorously enforcing these guidelines. Across the US, most local public entities (86%) lack ADA transition plans to implement accessibility improvements and maintenance for accessible travel pathways.²⁹ As the First State, there is a compelling call for stakeholders within Delaware to lead by example in addressing these regulatory gaps, ensuring compliance with ADAAG standards. Such initiative is crucial for the inclusive and accessible design, construction, and alteration of today's and tomorrow's parks and playgrounds.

Strengths and Limitations

This research study is characterized by notable strengths that enhance its impact. First, utilizing the CHII Tool, recognized for its validity and reliability, provides a robust framework for evaluating the accessibility of parks and playgrounds. The comprehensive nature of this tool enables a detailed examination of a multitude of critical accessibility factors, ranging from public transit and parking to internal environmental elements. Second, the study's diverse sampling strategy, featuring ten parks and playgrounds across different zip codes in New Castle County, Delaware, including both urban and suburban areas, significantly broadens the applicability of its findings. Third, the data collection, conducted by university students trained in adapted physical activity and employing standardized measurement tools, along with stringent data quality checks, significantly enhances the study's reliability and the credibility of its findings.

Despite its strengths, the study has several limitations that warrant consideration. First, its geographical focus on New Castle County, Delaware, may constrain the broader relevance of its findings to other areas in the US, as other regions in the US may present varied accessibility and usability challenges. Second, the study may be subject to selection bias due to the convenience-based choice of sites and the exclusion of parks with admission or parking fees. This approach might have restricted the comprehensive accessibility assessment across a broader range of public spaces. Third, a significant limitation of the study is its reliance on observational data, which may not fully capture the intricate experiences and perspectives of people with disabilities utilizing these parks and playgrounds. Gathering firsthand feedback from this group is essential for a complete and nuanced understanding of accessibility and usability issues and their impact on inclusion and PA participation. Such personal insights are vital for a comprehensive assessment of the intricacies that impact the influences of various environmental factors on the functioning and PA participation of people with disabilities within the ICF framework. Fourth, although efforts were made to ensure measurement accuracy, the inherent nature of manual tools and human observation can introduce minor errors or inconsistencies in data collection, potentially affecting the precision of the findings.

Conclusion

This research study significantly contributes to our understanding of public space accessibility, advocating for equitable access and active participation in recreational and PA environments. It underscores the imperative to develop inclusive public spaces that support active living and contribute to mitigating chronic disease risks among all community members, with a particular emphasis on those with disabilities. The findings represent a crucial call to action for current stakeholders, including policymakers, urban planners, and community organizations, who must unite with community members in their efforts to dismantle these barriers and reimagine public spaces that exceed mere legal compliance, striving instead for environments that are universally welcoming and accommodating to people regardless of disability status. This research underscores the importance of understanding accessibility as a dynamic, multi-faceted concept that goes beyond physical infrastructure. It calls for a more holistic approach to public space design that considers the diverse experiences and needs of people with disabilities and integrates these considerations into our community spaces. By doing so, we can ensure public parks and playgrounds are not just spaces for PA and recreation but also for social inclusion, health promotion, and community well-being.

Public Health Implication

This study addresses a critical aspect of public health by evaluating the accessibility and usability of parks and playgrounds in New Castle County, Delaware, for people with disabilities. It highlights the importance of inclusive public spaces in promoting PA and mitigating chronic disease risks. The findings reveal significant barriers to accessibility, underscoring the need for improvements in public transit, parking, and playground design, construction, and maintenance. By advocating for more accessible and inclusive recreational environments, this research contributes to the broader goal of reducing health disparities among people with disabilities and supports the public health vision of creating healthier communities for all. This study's outcomes are particularly relevant for policymakers, urban planners, and public health professionals, providing them with actionable insights to foster equitable access to PA opportunities and enhance the overall well-being of diverse community populations.

Dr. Obrusnikova may be contacted at obrusnik@udel.edu.

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