

ABSTRACT

NELSON, RILEY. Play for All: Access to Inclusive Playgrounds in Raleigh, North Carolina (Under the direction of Dr. Aaron Hipp).

This thesis explores the accessibility and inclusivity of public playgrounds in Raleigh, North Carolina, with a focus on identifying opportunities to enhance play environments for children of all abilities. Using the Playground Accessibility Rating Criteria (PARC) tool, 76 city-owned playgrounds were assessed based on features such as ramps, surface types, and accessible equipment. High- and low-inclusivity playgrounds were identified and analyzed using spatial analysis tools to evaluate proximity to residential populations, public transportation, walkability, and neighborhood economic conditions. The study incorporates demographic data from the American Community Survey and transportation data from GoRaleigh to better understand access to playgrounds across the city. While findings show variation in the distribution and features of inclusive playgrounds, many parks include elements that support accessibility and provide a foundation for future improvements. This research offers valuable insights for city planners and parks departments aiming to enhance inclusive play through informed, data-driven planning and design.

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Play for All: Access to Inclusive Playgrounds
in Raleigh, North Carolina

by
Riley Nelson

A thesis submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the
requirements for the degree of
Master of Science

Parks, Recreation, Tourism, and Management

Raleigh, North Carolina

2025

APPROVED BY:

Dr. Traci Rider

Dr. Aaron Hipp

Dr. Kyle Bunds

DEDICATION

To Dr. Aaron Hipp—thank you for your steadfast guidance and thoughtful mentorship throughout this journey. Your insight, encouragement, and commitment to meaningful research have profoundly shaped both this thesis and my development as a scholar.

To my parents—Mom and Dad, your unconditional love, constant encouragement, and belief in my abilities have sustained me through every challenge. You taught me the value of perseverance and the importance of purpose-driven work.

To Luke, my soon-to-be husband—thank you for your patience, strength, and steady presence. Your unwavering support and quiet confidence in me helped carry this project forward, even in its most difficult moments.

To my friends—your encouragement, laughter, and understanding reminded me to stay grounded and keep perspective. I am deeply grateful for your companionship along the way.

This thesis is a reflection of not only my work, but the love, support, and inspiration I've received from each of you.

BIOGRAPHY

Riley Nelson is a graduate student in Parks, Recreation, Tourism and Management at North Carolina State University, where she focuses on creating more inclusive and accessible public spaces through data-driven research and design. She holds a Bachelor's degree with an emphasis in Remote Sensing and Urban Development, which laid the foundation for her interest in spatial justice and inclusive design. Her current research explores the accessibility and inclusivity of playgrounds using tools such as ArcGIS and the Playground Accessibility Rating Criteria (PARC) tool. Riley works for Miracle League of the Triangle, a nonprofit dedicated to providing inclusive play opportunities for children with disabilities. She is passionate about leveraging data and design to inform city planning that supports all children's right to play. Upon graduation, she aims to continue advancing equity in urban policy and park development through research and community engagement.

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CHAPTER 1

Introduction:

Play is vital to children's social, emotional, intellectual, and physical development (Fernelius et al., 2017). Physical activity has positive effects on the independence of children with disabilities as well as quality of life (Kashi et al., 2023). However, children with disabilities are less likely to be physically active than their peers (Alghamdi et al., 2023) and children with disabilities tend to have less access to play (Smythe et al., 2023). Therefore, researchers need to evaluate the accessibility of inclusive play to understand the current barriers and opportunities to physical activity in children with disabilities in order to increase play for all.

When children engage in play, they not only experience joy and recreation but also develop essential social skills such as conflict resolution, negotiation, cooperation, and sharing (Rauf et al., 2019). These interactions help children learn how to navigate social situations, express emotions, and build relationships, which are critical skills that carry over into adulthood (Martinez et al., 2024). Play allows children to interact with the world around them and find independence in a safe environment. Physically active play can have positive effects on motor, social, and cognitive development as well as overall health (Crumbley et al., 2019). The health benefits of an active lifestyle extend beyond childhood. Research indicates that engaging in regular physical activity from an early age can reduce the risk of chronic illnesses such as obesity, diabetes, cardiovascular diseases, and even mental health disorders like anxiety and depression (Brockman et al., 2011). Furthermore, lifestyle habits, including physical activity levels, are often established during childhood and adolescence and have a strong likelihood of

persisting into adulthood (Rauner et al., 2015). This highlights the importance of fostering active play and movement during early years to promote long-term health and well-being.

The Centers for Disease Control recommends that children age 6 to 17 participate in physical activity for 60 minutes per day (CDC, 2024). Regular physical activity is essential for building strong bones and muscles, maintaining a healthy weight, improving cardiovascular health, and reducing the risk of developing chronic illnesses such as obesity, type 2 diabetes, and heart disease (Darren et al., 2006). Additionally, physical activity outdoors has been linked to a lower risk to poor mental health (Richard, 2013). One of the most commonly used locations for facilitating children's physical activity are playgrounds and parks (Corder et al., 2011). Playgrounds encourage physical activity by offering a free and accessible public space where children and families can play, exercise, and enjoy the outdoors. Research shows that playgrounds play a crucial role in encouraging children to engage in movement and exercise. Compared to other areas within parks, such as open fields, picnic areas, or walking paths, children are significantly more likely to participate in moderate to vigorous physical activity when using playgrounds (Cohen et al., 2019). Studies have found that when children play on playgrounds, they spend, on average, 38% of their playtime engaged in moderate to vigorous physical activity (Adams et al., 2018). This means that playgrounds contribute substantially to children's daily exercise requirements, making them an essential resource for promoting a physically active lifestyle.

Childhood Disability

According to the United States Department of Education, in 2010 there were 45,056,472 students ages 6 through 21 that were enrolled in the education system; out of these students,

12.9% had some form of disability (United States Department of Education, 2010). Within North Carolina alone there were 1,351,313 students and 12.5% of those students had some form of disability (United States Department of Education, 2010). Based on data from the Centers for Disease Control and Prevention, the United States child disability rates have increased between 2008 to 2019. In 2019, there were over three million children with some form of disability. Disability rates for children are the highest within low-income areas (CDC, 2021). As stated by the United Nations Convention on the Rights of the Children (UN CRC), “accessible and inclusive environments and facilities must be made available to children with disabilities, to enable them to enjoy their rights (UN CRC, 1989, Article 31). The Convention on the Rights of Persons with Disabilities aims to “ensure that children with disabilities have equal access with other children to participation in play, recreation, leisure, and sporting activities” (UN CRPD, 2006). Parents who have children with physical disabilities are most often worried about inaccessible physical environments (e.g., lack of sidewalks or paths with only stairs) - at home as well as nearby areas - and a lack of transportation systems; barriers often mentioned throughout the literature (Kang et al., 2017). As such, distance and accessibility are likely the most significant factors associated with playground usage in children with disabilities (Young et al., 2023). Residents who live within a ½ mile of a playground have 5.1 times the odds of using the space and residents who could walk or bike to the playground had 6.1 times the odds of using the space (Young et al., 2023).

Within a survey conducted about community playgrounds, caregivers of young children with disabilities noted that there is a need for inclusive playgrounds for young children only, playgrounds that would provide a peer support network for caregivers who have a child with a disability, playgrounds that would allow a child with disabilities to develop friendships, and a

need for playgrounds to meet the needs of young children with sensorimotor concerns (Stanton-Chapman et al., 2017). Caregivers of children with disabilities noted the segregation that occurs on playgrounds with children with disabilities and children without disabilities and how there is often a lack of accessible equipment for children with physical disabilities (Stanton-Chapman et al., 2017). Inclusive playgrounds are designed to be barrier-free environments that promote equal participation and opportunities for children of all ages and abilities.

Inclusive playgrounds are vital for not only children with disabilities but also children without disabilities. Children without disabilities experience reasonable levels of ambulatory activity on inclusive playgrounds and can achieve moderate or higher intensity exercise and heart rate on inclusive playgrounds (Stevens et al., 2023). Inclusive playgrounds allow for children with and without disabilities to be physically active together and independently. Playgrounds serve as a space for children to engage in social play and interact with peers (Parker et al. 2006). By creating a play space for children with and without disabilities, there is the potential to create spaces that allow for social connection (Boyd, K. A., 2023).

With this thesis, I will examine the accessibility and availability of inclusive playgrounds in Raleigh, North Carolina, with the goal of promoting equal opportunities for all children to engage in play. Currently, there is a gap in the literature and available datasets and dashboards surrounding access to inclusive playgrounds. The overarching purpose is to use geospatial information systems to understand the availability of, and gaps in access to, inclusive playgrounds, the distribution of inclusive playgrounds, the forms of access, such as public transportation or walkability, available to reach these playgrounds, and the demographics of the areas where inclusive playgrounds are currently located.

Methods

To fully understand access to inclusive playgrounds, we need to conduct a comprehensive analysis of their current distribution in relation to population demographics. This involves mapping playground locations and assessing their proximity to communities, particularly those with higher concentrations of individuals with disabilities. Additionally, we must evaluate the accessibility of these playgrounds based on available transportation options, including public transit routes, greenways, and ADA-compliant bus stops to determine how easily they can be reached by children and caregivers. Within this thesis accessibility refers to the ease with which individuals, particularly children and caregivers with disabilities, can reach and use playground spaces through available transportation networks and surrounding infrastructure. This includes proximity to ADA-compliant bus stops, the walkability of the surrounding neighborhood and the geographic location of the playground in relation to the demographic make up of the City of Raleigh.

Beyond geographic access, a detailed audit of each playground is essential. This audit includes an evaluation of the available playground equipment and ADA compliance of pathways. Furthermore, considerations such as signage, parking availability, and the overall inclusivity of the park environment should be examined to ensure equitable access for all children, regardless of ability.

Study Setting :

This case study will focus on public playgrounds in Raleigh, North Carolina. Public playgrounds will be defined as those owned by the City of Raleigh. The City of Raleigh has a population size of 546,562 individuals (American Community Survey, 2023). Within Wake

County, there are 290 parks, within the City of Raleigh there are 125 parks and 76 of the parks have playgrounds. About 20% of the population in the Raleigh-Cary area is under 18 years old (U.S. Census Bureau, 2022). Raleigh was selected in order to conduct in-person audits to ensure that playgrounds meet the requirements for being inclusive playgrounds and that the requirements for accessibility based on the Americans with Disabilities Act (ADA) are truly met.

Study Design:

The study design will be a case study based on 76 parks with playgrounds within the City of Raleigh, North Carolina. The case study will focus on access to inclusive playgrounds for children with disabilities. Accessibility will be evaluated based on several factors, including the availability of public transportation to reach these playgrounds, playground proximity to populations with disabilities, and overall walkability proximate playgrounds. By investigating the different spatial relationships present, we will have a better understanding of the access available to playgrounds that best suit the needs of children with disabilities.

Table 1: Data Sources

Data Source	Year	Type	Purpose	Link
PARC (Playground Accessibility Rating Criteria) Audit Tool	2016	Playground Audit	Assess physical and accessibility features of playgrounds (equipment, surfacing, amenities).	Perry et al.
EPA Walkability	2024	Polygon Data	Measure walkability scores for neighborhoods. Available at block group level.	Walkability

Table 1 (continued).

Wake County Parcel	2024	Parcel/Polygon Data	Determine residential and industrial areas near playgrounds.	Wake County Parcel
City of Raleigh Parks	2019	Point Data	Identify playground locations and available facilities.	Raleigh Parks
GoRaleigh Bus Stops	2024	Point Data	Map public transportation access, ADA compliance, and connectivity to playgrounds.	GoRaleigh Bus Stops
American Community Survey	2023	Demographic Data	Analyze the distribution of disabilities, race/ethnicity, and children within Wake County.	American Community Survey
Wake County Economic Health Map	2023	Polygon Data	Analyze the economic health of where parks are currently located. Provides economic health score at block group level based on five criteria.	Economic Health
Wake County Greenways	2023	Line Data	Map park access to greenways across the City of Raleigh.	Greenways

Table 1 (continued).

Wake County Jurisdictions	2024	Polygon Data	Determine the jurisdictions of the playground locations.	Jurisdictions
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Measures/Instrumentation/Research

Procedures:

Playground Accessibility

The study begins with a playground accessibility audit to evaluate the accessibility features of 76 public playgrounds in Raleigh, North Carolina. Using the PARC (Playground Accessibility Rating Criteria) Tool, the audit examines various aspects of each playground, including accessible equipment such as transfer steps (A low, stable platform or series of steps that allows a child to transfer independently or with assistance from a wheelchair onto a play structure like a slide, climber, or elevated platform) and full-body support swings (A swing with a high-back seat, harness, and leg support that offers safe and secure swinging for individuals who need full postural support), surface types on playgrounds and pathways, and amenities like ramps, restrooms, and parking spaces for wheelchair-accessible vehicles.

Playgrounds will be evaluated based on audit responses, with those receiving a higher number of "yes" answers indicating greater accessibility, while those with more "no" answers will be considered less accessible. The audit is split into five main categories of parking, preschool play, main play, paths, and facilities. Accessibility scores will be determined by tallying the total number of "yes" and "no" responses within each of the five categories. Some categories have no points due to there not being equipment or facilities available. For parks that do not have preschool play areas or facilities, the number of total questions used to calculate the

total percent will be adjusted accordingly. If a playground does not have a preschool area, the total percent will be calculated out of 54 questions. If a playground does not have facilities, the total percent will be calculated out of 82 questions. If a playground does not have facilities and does not have a preschool play area, the total percent will be calculated out of 50 points. The top 25 scoring parks, as a percentage of available points, will be categorized as high-inclusive, and the bottom 25 scoring parks will be categorized as low-inclusive. These calculations were adjusted due to the fact that facilities such as restrooms are not placed at parks due to the surrounding areas offering the amenity and therefore to ensure a fair comparison the points were adjusted. The points were also adjusted for preschool areas due to the fact that some playgrounds incorporated the younger kids' play within the main play area; therefore, it would not be able to have a separate score. Scores for parking, main play, and pathways were not adjusted due to these amenities always being available in some form around the park.

Demographic Data

A demographic and economic analysis is conducted to understand the characteristics of populations near the playgrounds. Using American Community Survey (B1810 |2023) data, the distribution of individuals with disabilities across census block groups is mapped, along with the economic conditions using the economic health map by Wake County (<https://www.wake.gov/departments-government/planning-development-inspections/planning/social-equity-atlas>). The economic health map measures health by looking at median household income, amount of individuals on food stamps, rent as greater than 30% of income, home mortgage as greater than 30% of income, mortgage status by owner cost as a percentage of household income, and persons living 100%–200% of the federal poverty level (2023). The

block groups are split into categories of most healthy, above average, average, below average, and least healthy. The American Community Survey also provides race and ethnicity data of the population, which can also be used to analyze whether certain race groups live closer to high or low inclusive playgrounds. By summarizing the number of playgrounds within census groups based on demographic and economic data, this step highlights disparities in playground accessibility related to socioeconomic factors. Below in figure 1 are the questions asked by the American Community Survey in order to understand whether an individual has a disability. If any question is answered as yes, the person is noted as disabled.

Figure 1: American Community Survey 2023 Disability Question

The image shows a vertical list of survey questions on a light green background. Each question is preceded by a circled number (18, 19, or 20). Questions 18 and 19 have two sub-questions (a and b). Each sub-question is followed by two radio button options: 'Yes' and 'No'.

18 a. Is this person deaf or does he/she have serious difficulty hearing?
 Yes
 No

b. Is this person blind or does he/she have serious difficulty seeing even when wearing glasses?
 Yes
 No

19 a. Because of a physical, mental, or emotional condition, does this person have serious difficulty concentrating, remembering, or making decisions?
 Yes
 No

b. Does this person have serious difficulty walking or climbing stairs?
 Yes
 No

c. Does this person have difficulty dressing or bathing?
 Yes
 No

20 Because of a physical, mental, or emotional condition, does this person have difficulty doing errands alone such as visiting a doctor's office or shopping?
 Yes
 No

American Community Survey 2023 questions used to understand whether an individual has a disability or not.

Public Transportation

The study also evaluates public transportation access to playgrounds using GoRaleigh Bus Stops data. A half-mile buffer is created around each bus stop to determine which playgrounds and residential parcels fall within this range. The GoRaleigh bus stop data highlights whether a bus stop is considered ADA-compliant. In order to be ADA-compliant, the bus stop is required to have signage informing the route of the bus, the landing pad must be made of a firm stable substance, benches need to be present, and shelters that have room for both the bench and individuals with wheelchairs. Using this data, ADA-compliant bus stops can be separated out and then selected to see if they fall within a half-mile radius of a playground. This analysis identifies how accessible playgrounds are for those reliant on public transportation.

Walkability

To further explore accessibility, a walkability assessment was conducted using the EPA Walkability Index (U.S. Environmental Protection Agency, 2024). This data categorizes neighborhoods based on their walkability scores, considering factors like street intersection density, proximity to transit stops, and the diversity of land use in the area. Each block group is then given a score from 1 to 20. Block groups that score from 1 to 5.75 are considered least walkable, 5.76 to 10.5 are considered below-average walkable, 10.51 to 15.25 are considered above-average walkable, and 15.26 to 20 are considered most walkable. The relationship between playground locations and walkability ratings is analyzed to determine whether

playgrounds are situated in walkable neighborhoods, enhancing accessibility for nearby residents.

The findings from these analyses are integrated through spatial mapping and accessibility scoring. Spatial maps are created to visualize accessibility levels, demographic distributions, economic conditions, transportation access, and walkability in relation to playground locations. Tools such as buffering, intersection, and hot spot clustering are used to identify areas with high or low accessibility (ESRI 2022. ArcGIS Pro Desktop: 3.0.2. Redlands, CA: Environmental Systems Research Institute). The Hot Spot Analysis tool in ArcGIS Pro is a spatial statistics tool that identifies statistically significant spatial clusters of high or low values in a dataset.

To assess overall access to highly and minimally inclusive playgrounds, this study will integrate accessibility audits, residential proximity data, demographic and economic analyses, transportation availability, and walkability assessments. T-tests will be conducted to determine whether there are significant differences in the racial and ethnic composition of populations surrounding the playgrounds, as well as in economic factors and walkability measures.

Analysis

Tools such as buffer, summarize within, calculate area, calculate geometry, and pairwise intersect will be used during the analysis. Calculate area (determine the surface size of a shape or region), calculate geometry (analyze or compute the shapes and spatial characteristics of geographic features), and pairwise intersect (identify overlapping areas between pairs of geographic features) will be used in order to calculate the potential amount of individuals within a buffer (a zone extending a set distance from a geographic feature). Half-mile buffers (zones that extend 0.5 miles from each playground) will be used around each playground. Calculate area

will be used to find the area for each block group. A pairwise intersect will be used to pair the buffer circle with only the parts of the block groups that intersect with the half-mile buffer. Calculate area will then be used again to determine what percent of each block group is within the buffer. The percent will be calculated in a new column by dividing the area within the buffer by the total area of the block group. This percentage can then be used to calculate the population that could potentially be within the buffer by multiplying the population by the percentage. From there, tools such as summarize within can be used to understand the total amount of individuals within all of the block groups or within areas only surrounding the high or low inclusive playgrounds. Summarize within can also be used to calculate the number of playgrounds that are within economic health categories. Once the data is calculated for each playground, IBM SPSS Version 26 (Statistical Package for the Social Sciences) was used to conduct T-tests to see whether the differences between high and low inclusive playgrounds are statistically significant. A hot spot analysis was also conducted with ArcGIS Pro to see the areas that are most statistically significant for playground locations. The analysis was conducted on low inclusive parks, high inclusive parks, and all of the parks.

Chi-square regression is used to explore the relationship between playground inclusivity and various socioeconomic and infrastructural factors (<https://www.socscistatistics.com/tests/chisquare2/default2.aspx>, 2018). Specifically, the analysis examines whether the distribution of high- and low-inclusivity playgrounds in Raleigh, North Carolina is associated with neighborhood income levels, economic health, access to ADA-compliant bus stops, and proximity to greenways. By applying chi-square tests of independence, the study assesses whether these categorical variables—such as economic health

rating or income bracket—are significantly related to the type of playground (high or low inclusivity) found in each area.

Data Equity

Data equity in the context of auditing playgrounds for accessibility involves ensuring that all communities have equal access to accurate and comprehensive information about the play spaces available to them. By using inclusive data collection methods that encompass full audits of the City of Raleigh playgrounds, we can identify barriers that may prevent children with disabilities from fully enjoying these areas and find areas that could potentially benefit from the installation of an inclusive playground. This approach not only highlights disparities in access but also drives informed decisions for equitable resource allocation and improvements, fostering an inclusive environment where all children can play and thrive.

Results:

Overview of Parks and Playgrounds in Raleigh

Wake County, North Carolina, contains a total of 290 parks, with 125 owned and maintained by the City of Raleigh. Of these, 76 parks include playgrounds available for public use. According to the American Community Survey (2023), the estimated population of Raleigh was 546,562 individuals. Of this total, 138,367 residents (25.3%) lived within a half-mile radius of a public, City of Raleigh playground. Around 408,195 (74.68%) of Raleigh residents do not live within a half-mile radius of a City of Raleigh playground. Among Raleigh's 82,456 children, 21,922 (26.59%) resided within a half-mile of a playground, suggesting that over a quarter of the city's youth population had access to nearby play areas. Around 60,534 (73.41%) of Raleigh children do not live within a half-mile radius of a playground, which means that almost three-quarters of

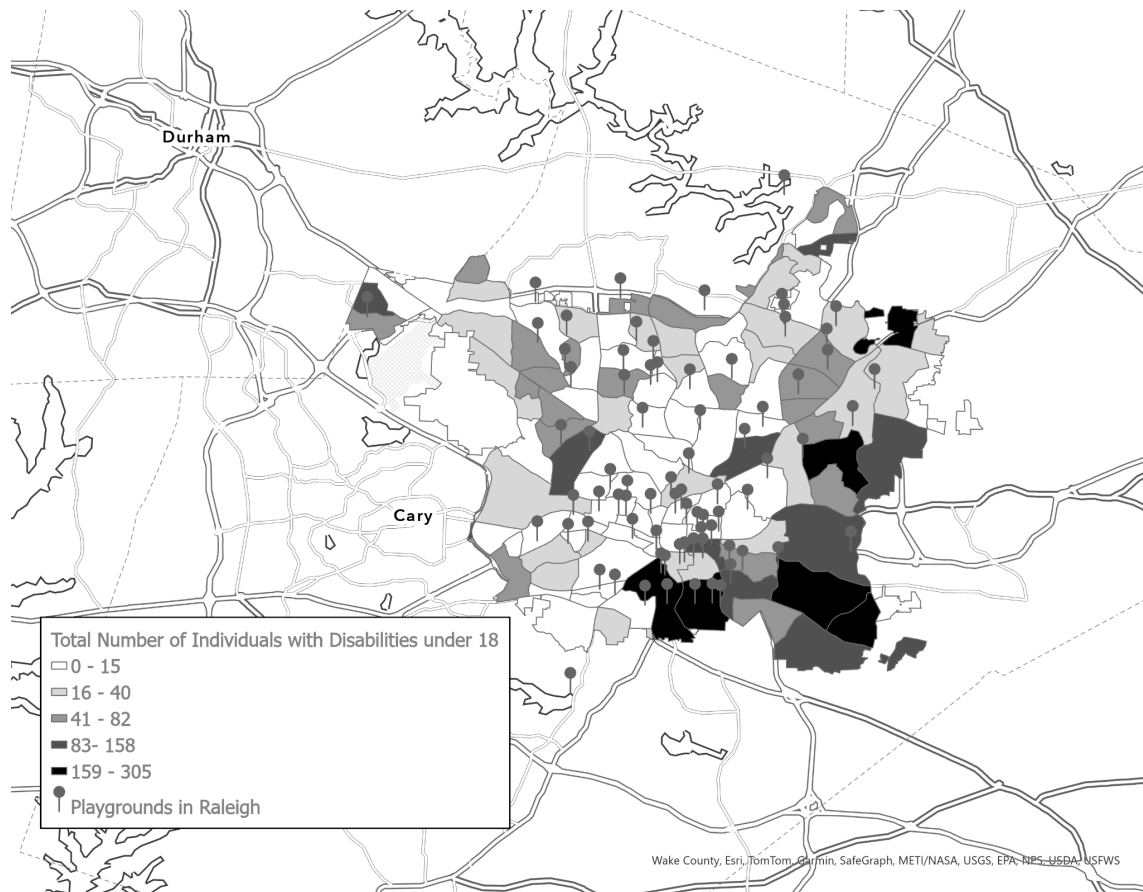
Raleigh children do not have access to nearby public play areas. Within Raleigh, there are approximately 5,199 children with disabilities. Out of the 5,199 children with disabilities, 1,606 (30.88%) live within a half-mile radius of a playground, and 3,593 (69.12%) do not live within the radius. In Raleigh, there are 148,337 Black residents, of whom 42,619 (28.73%) live within a half-mile radius of a playground, while 105,718 (71.27%) do not. Among the 313,070 White residents, 73,526 (23.49%) are within the half-mile radius, and 239,544 (76.51%) are outside it. For the 74,317 Hispanic or Latino residents, 20,843 (28.05%) live within the radius, compared to 53,474 (71.95%) who do not. The city’s overall average median household income is \$89,661.09. However, income differs based on proximity to playgrounds: households within the half-mile radius have an average median income of \$81,245.58, whereas those outside the radius average \$95,286.94.

Table 2: Demographic Data for the City of Raleigh

	Raleigh Population within Jurisdiction	Population (%) Within the playground ½ mile buffer	Population (%) Not within ½ mile buffer
Total population	546,562	138,367(25.3%)	408,195(74.68%)
Kid population	82,456	21,922(26.59%)	60,534(73.41%)
Kids with disabilities population	5,199	1,606(30.88%)	3,593(69.12%)
Black	148,337	42,619(28.73%)	105,718(71.27%)
Hispanic	74,317	20,843(28.05%)	53,474(71.95%)
White	313,070	73,526(23.49%)	239,544(76.51%)
Average Median Household Income	\$89,661.09	\$81,245.58	\$95,286.94

Highlights demographic from American Community Survey 2023 data for all of Raleigh, block groups that are within a half-mile radius of a playground, and areas outside of the radius.

Figure 2: Population of Individuals under 18 with Disabilities in Raleigh, North Carolina



Playground locations in the City of Raleigh in comparison to the total number of individuals with disabilities under 18 years of age.

Demographics of Parks

Among the 76 parks with playgrounds, each was assessed and assigned a score based on the inclusivity of its equipment and surrounding environment, with a possible percent score of 100%. The PARC tool assesses elements such as accessible walkways, ramps, restrooms, and

designated parking areas for individuals with disabilities. Each playground could earn a maximum score of 86 points, with higher scores indicating a greater presence of inclusive equipment and amenities. The scoring system operates on a binary scale, where each question is assigned one point for a "yes" response and zero points for a "no" response.

To determine the percentage of "yes" responses, the total number of parks that answered "yes" to each individual question was summed and then divided by the total number of parks. For questions specific to preschool play areas, percentages were calculated based on a smaller sample size. Out of the 76 total parks analyzed, only 43 had designated preschool play areas. As a result, percentages for preschool-related features were derived from this subset rather than the full dataset. The 25 highest-scoring playgrounds were categorized as high-inclusivity, while the 25 lowest-scoring were classified as low-inclusivity. Playgrounds were scored by five sub-areas: parking, facilities, paths, main play, and preschool play, with a possible total score of 86 points.

Table 3: Average PARC Score per Sub-Area

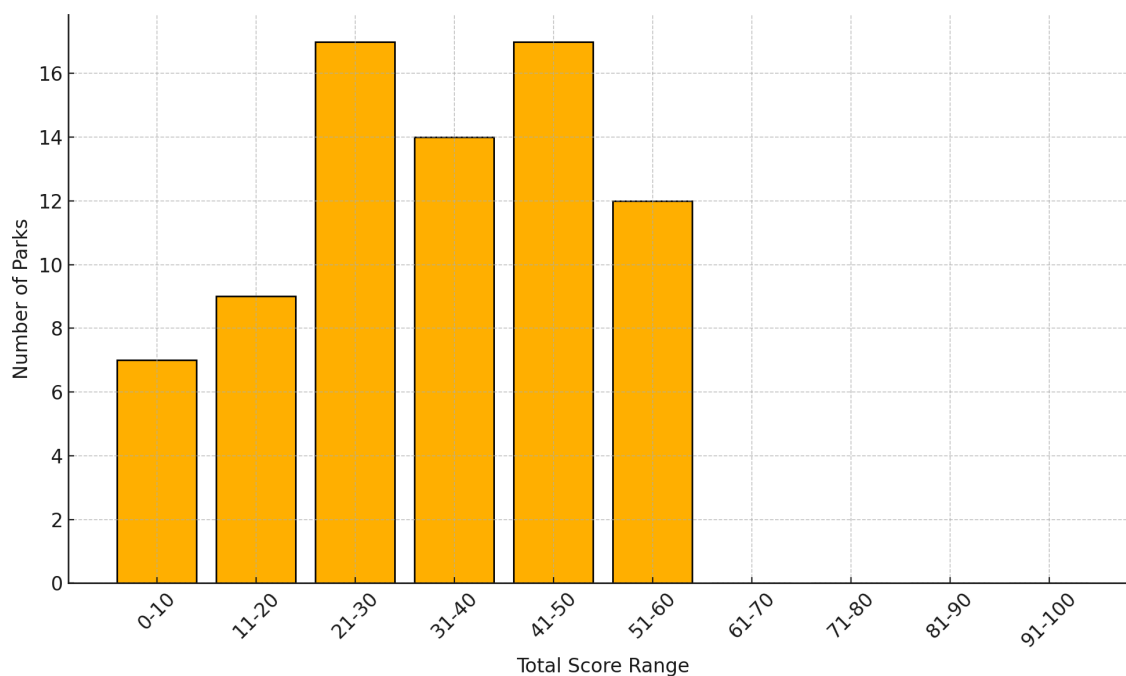
	All playgrounds (Standard Deviation)	25 high inclusive (Standard Deviation)	25 low inclusive (Standard Deviation)
Average Total Points (out of 86 points)	33.54pts(15.73)	46.46pts(10.45)	16.54 pts(8.66)
Average score per sub-area: Parking (out of 8 points)	5.45 pts(3.63)	7.54 pts(1.84)	2.65 pts(3.62)
Average score per sub-area: Paths (out of 10 points)	6.01 pts(2.59)	7.58 pts(.86)	3.73 pts(2.78)
Average score per sub-area: Facilities (out of 4 points)	1.38 pts(1.39)	1.58 pts(1.42)	0.65 pts(1.16)

Table 3 continued.

Average score per sub-area: Preschool Play (out of 32 points)	12.30 pts(8.28)	17.42 pts(9.42)	6.92 pts(3.86)
Average score per sub-area: Main Play (out of 32 points)	8.39 pts(5.58)	12.35 pts(3.31)	2.58 pts(3.83)

Average scores for each sub-area of the PARC tool, along with the overall average score and the standard deviation.

Figure 3: Number of Parks per PARC Score



Distribution of PARC scores based on the total points received

Table 3 highlights a significant difference between high-inclusivity and low-inclusivity playgrounds for all five sub-areas and the total scores, as expected and designed. The average PARC score for all of the playgrounds was 33.54 points. For high-inclusive parks, the average

score was 46.46 points out of a possible 86 points, and for low-inclusive playgrounds, the average score was 16.54 points. For parking, the average score for all of the playgrounds is 5.45 points out of a possible 8 points. For high-inclusive parks, the average score was 7.54 points, and for low-inclusive parks, the average score was 2.65 points. The average score for all of the playgrounds for paths was 6.01 points, and the average for low-inclusive playgrounds was 3.73 points. High-inclusive playgrounds scored on average higher at 7.58 points. The average score for all of the playgrounds for facilities was 1.38 points, and the average for low-inclusive playgrounds was .65 points. High-inclusive playgrounds scored on average higher at 1.58 points. The average score for all of the playgrounds for preschool play was 12.3 points, and the average for low-inclusive playgrounds was 6.92 points. High-inclusive playgrounds scored on average higher at 17.42 points. The average score for all of the playgrounds for main play was 8.39 points, and the average for low-inclusive playgrounds was 2.58 points. High-inclusive playgrounds scored on average higher at 12.35 points. Out of 86 points, the highest-scoring playgrounds received 60 points in total. There are three playgrounds that received 60 points total: Forest Ridge Park, John Chavis Memorial Park, and Laurel Hills Park. The lowest score was 4 points out of a total of 86, two separate parks scored 4 points the first was Berkshire Downs West park and the second was Lenoir Street park.

The populations surrounding high and low inclusivity are pretty similar overall; however, Table 2 shows that there is a significant difference in the total populations that are White, American Indian, or Asian. High-inclusivity parks collectively serve 7785 children residing in block groups that intersect with a half-mile radius around each park—representing 9.44% of Raleigh’s children. Meanwhile, low-inclusivity parks serve 6249(7.58%) children within similarly defined block groups.

Table 4: PARC and Demographic T-test Data

	All playgrounds	25 high inclusive	25 low inclusive	T-test (p-value)*
Average Total Points (out of 86 points)	33.54pts	46.46pts	16.54	-11.25(<0.001)
Average score per sub-area: Parking (out of 8 points)	5.45 pts	7.54 pts	2.65 pts	-6.13(<0.001)
Average score per sub-area: Paths (out of 10 points)	6.01 pts	7.58 pts	3.73 pts	-6.75 (<0.001)
Average score per sub-area: Facilities (out of 4 points)	1.38 pts	1.58 pts	.65 pts	-2.56 (0.007)
Average score per sub-area: Preschool Play (out of 32 points)	12.3 pts	17.42 pts	6.92 pts	-10.58(<0.001)
Average score per sub-area: Main Play (out of 32 points)	8.39 pts	12.35 pts	2.58 pts	-4.89(<0.001)
Total Kid Population within ½ mile buffer of playground	21,922.05	7,784.94	6,248.43	-1.17(.124)
Total Kid with disabilities Population within ½ mile buffer of playground	1,605.66	520.41(32.41%)	532.42(33.16%)	.144(.443)
Total Population within ½ mile buffer of playground	143,007.09	50,038.35	42,964.74	-1.30(0.100)
Total White Population within ½ mile buffer of playground	73,525.71	27,239.73	20,773.46	-1.90(0.032)

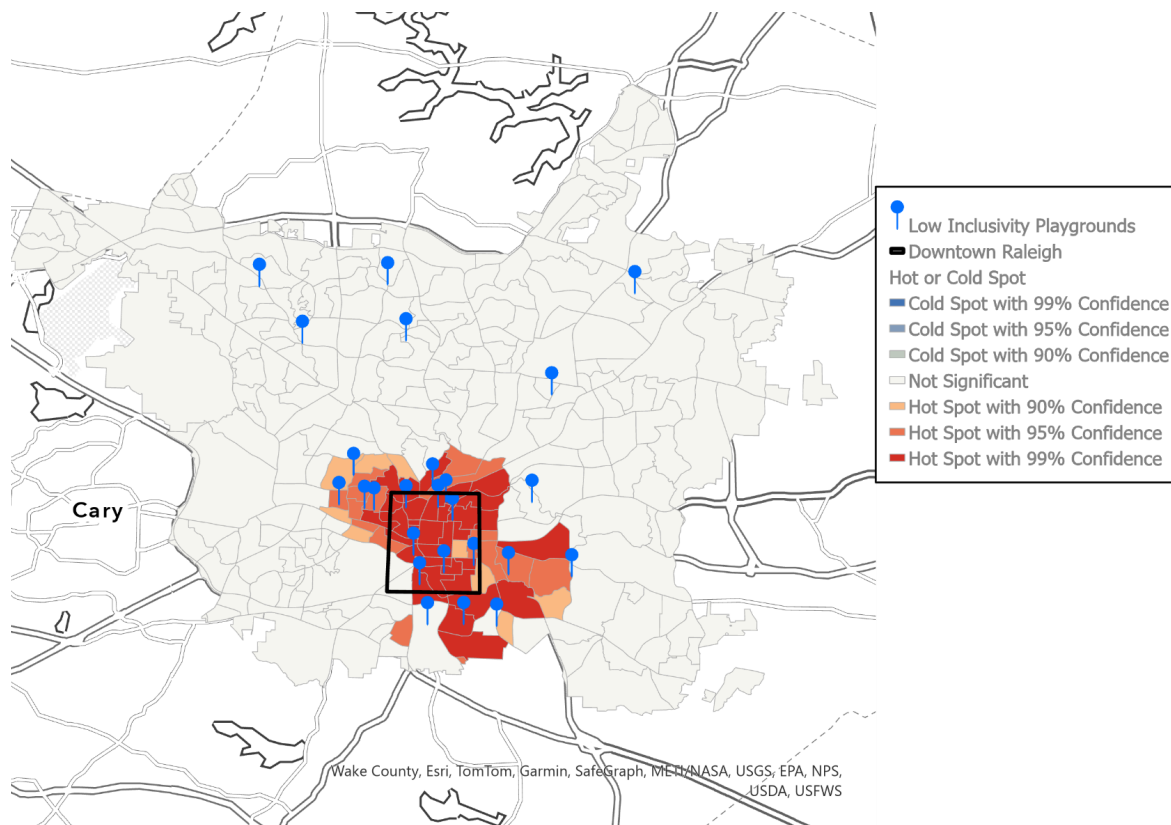
Table 4 continued.

Total Black Population within ½ mile buffer of playground	42,618.67	13,036.49	14,537.07	.374(0.355)
Total American Indian Population within ½ mile buffer of playground	373.12	151.78	70.56	-1.71(0.047)
Total Asian Population within ½ mile buffer of playground	5,616.27	2,446.18	1,057.32	-1.58(0.06)
Total Native Hawaiian Population within ½ mile buffer of playground	30.32	10.72	19.61	.535(0.297)
Total Hispanic Population within ½ mile buffer of playground	20,843	7,203.53	6,488.73	-3.22(0.374)
Median Household Income	81,245.58	85,232.2	78,488.31	-.659(0.257)
National Walkability Index (Out of 20)	11.86	13.59	11.21	2.54(0.007)

**footnote - T-test between high and low inclusive*

Average PARC scores for playgrounds, total populations, median household income, and national walkability index within a half-mile radius of playgrounds. The population is an estimate of the number of individuals that would fall within the radius based on the percentage of area of the block group within the radius.

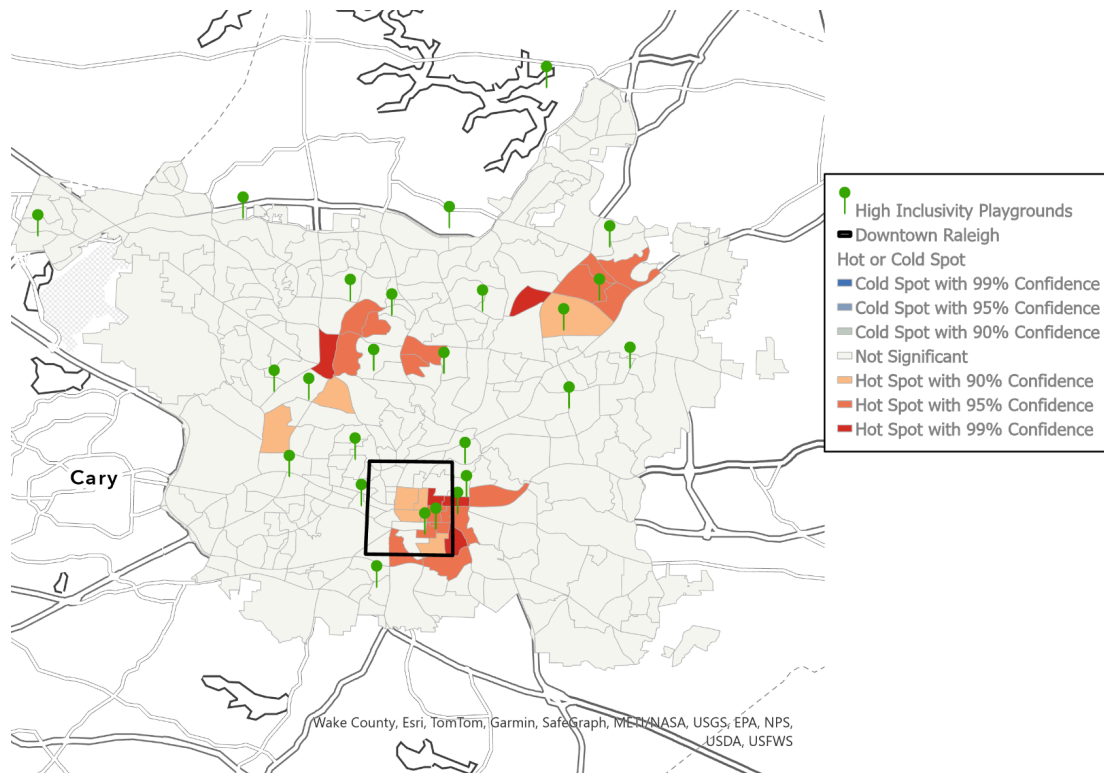
Figure 4: Hot Spot Analysis of Low Inclusivity Playgrounds



Hot Spot Analysis of Low Inclusivity playgrounds. The black box represents the general area of Downtown Raleigh.

Figure 4 displays a hot spot analysis of low-inclusivity playgrounds. The analysis identifies geographic clusters where low-inclusivity playgrounds are concentrated. Areas in red or orange likely indicate statistically significant clusters of playgrounds with low accessibility scores. The black box outlines Downtown Raleigh, where many of these parks are located. Looking at the area of Downtown Raleigh, there are several block groups that have hot spots with 99% confidence - areas of spatial clustering of low PARC score.

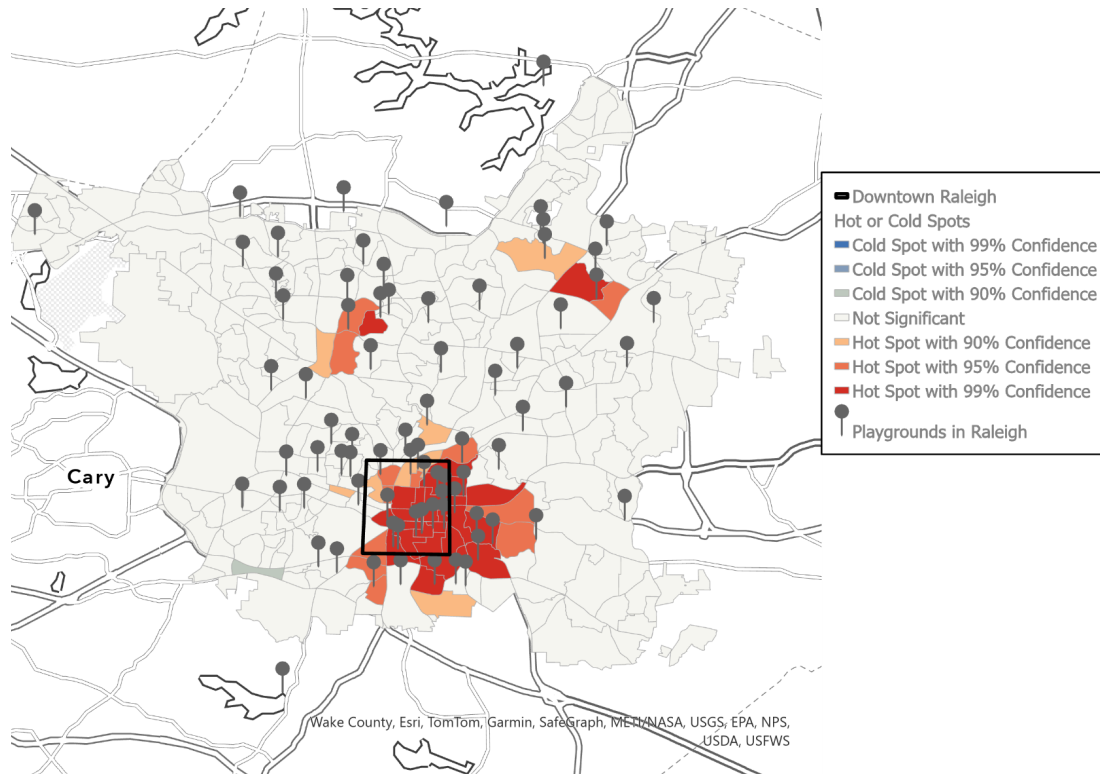
Figure 5: Hot Spot Analysis of High Inclusive Playgrounds



High Inclusive playgrounds with hot spots showing where the high inclusive playgrounds are most statistically to be located.

Figure 5 highlights the locations of high-inclusivity playgrounds. Visually, this map shows that many high-inclusivity parks are more dispersed and often found outside of the urban area. While there are some hot spots within Downtown Raleigh, there are a few with 99% confidence towards the northwest and northeast areas.

Figure 6: Hot Spot Analysis for All Playgrounds



All parks with playgrounds in Raleigh, North Carolina with hot spots showing where the parks are most statistically located.

Figure 6 shows the geographic distribution of all 76 public playgrounds across Raleigh, North Carolina. A noticeable concentration of playgrounds is present in the downtown Raleigh area, forming a visible hot spot. This clustering closely aligns with the pattern observed in Figure 4, which highlights hot spots of low-inclusivity playgrounds. A majority of the block groups with 99% of confidence are in the downtown area.

Economic Health Disparities

Raleigh demonstrates notable disparities in economic health across its block groups. Economic health is assessed using metrics such as median household income, the percentage of households receiving food stamps, the percentage of individuals living near the poverty line, and housing costs as a percentage of income for both renters and homeowners. Approximately 26.62% of Raleigh's block groups are classified as more economically healthy, 22.40% have average economic health, and 12.34% are economically less healthy. Of the 76 playgrounds, 39.50% are in areas with more healthy economic conditions, 14.50% are in areas with average economic health, and 9.20% are in economically less healthy areas. Among the 25 playgrounds categorized as highly inclusive, 16 (64.00%) are located in economically healthy or above-average areas. In contrast, of the 25 playgrounds identified as having low inclusivity, 17 (68.00%) are situated in economically healthy or above-average areas. Five (20.00%) of both the low-inclusivity and high-inclusivity are considered to be in areas that are below average or less economically healthy. There is a 12.88% difference between all playgrounds that are in more economically healthy areas and census block groups that are considered more economically healthy. There is a 3.14% difference between all playgrounds that are in less economically healthy areas and census block group areas that are considered less economically healthy.

Table 5: Economic Health Rating for Block Groups and Playgrounds

	Raleigh, NC Block Groups (n=308)	All Playgrounds (n = 76)	25 High Inclusive (n=25)	25 Low Inclusive (n=25)
Less Healthy	38(12.34%)	7(9.20%)	2(8.00%)	3(12.00%)
Below Average	51(16.56%)	7(9.20%)	3(12.00%)	2(8.00%)
Average	69(22.40%)	11(14.50%)	4(16.00%)	3(12.00%)
Above Average	68(22.08%)	21(27.60%)	4(16.00%)	7(28.00%)
More Healthy	82(26.62%)	30(39.50%)	12(48.00%)	10(40.00%)

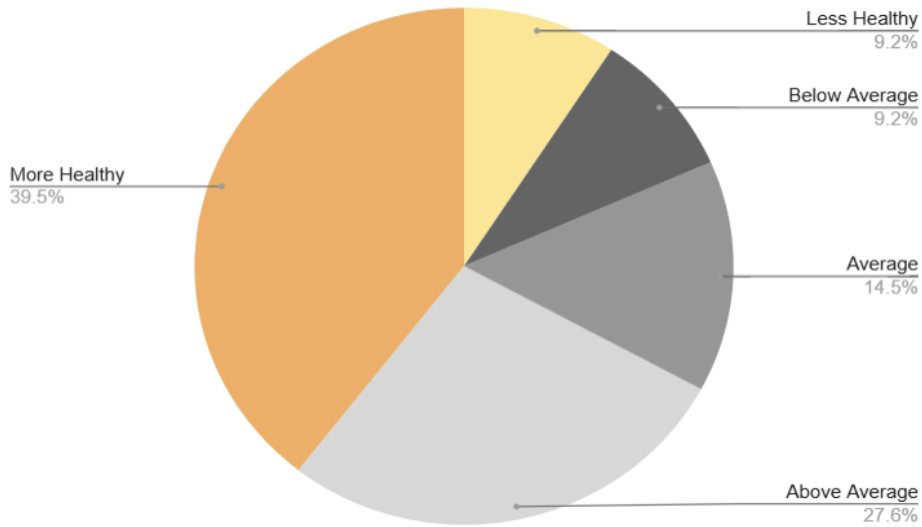
Playgrounds economic health rating. Percent is based on the number of the type of playground.

Table 6: Economic Health Chi-square Regression

Health Level	High Inclusive	Low Inclusive
Less Healthy	2 (2.50) [0.10]	3 (2.50) [0.10]
Below Average	3 (2.50) [0.10]	2 (2.50) [0.10]
Average	4 (3.50) [0.07]	3 (3.50) [0.07]
Above Average	4 (5.50) [0.41]	7 (5.50) [0.41]
Most Healthy	12 (11.00) [0.09]	10 (11.00) [0.09]

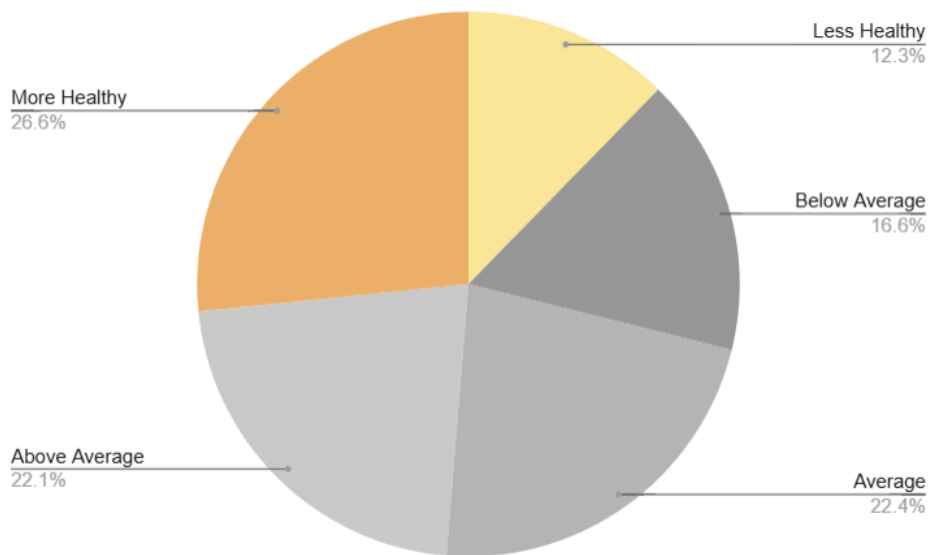
Economic Health Chi-square regression to understand relationship between high-inclusive and low-inclusive parks.

Figure 7: Economic Health Distribution of Playgrounds in Raleigh, North Carolina



Economic health distribution of playgrounds within Raleigh, North Carolina. Total of 76 playgrounds.

Figure 8: Economic Health of Census Block Groups in Raleigh, North Carolina



Economic health distribution within Raleigh, North Carolina. Total of 308 Census Block Groups.

Income Distribution and Playgrounds

Playgrounds in Raleigh also reflect varying income distributions. Of the 76 playgrounds, 51 (67.11%) are located in areas with incomes ranging from \$0–\$89,947, while 14 playgrounds (18.42%) are in areas with incomes between \$127,386.01 and \$250,001. Similarly within the entire city of Raleigh, 173 block groups (56.17%) fall within the \$0–\$89,947 income range, and 66 block groups (21.42%) are in the \$127,386.01–\$250,001 range. Income ranges were based on ranges used to calculate the economic health scores. Both high- and low-inclusivity playgrounds share similar income distribution patterns, with 68% located in areas with income ranges of \$0-53,101 and \$53,101.01-\$89,947. As seen in Table 5, 4(5.26%) playgrounds are within areas that have median incomes of \$168,864.01 - \$250,001. Table 8 shows that 3 of these playgrounds are considered high-inclusivity playgrounds. None of the parks within the \$168,864.01 - \$250,001 range are considered low inclusivity. Both high-inclusivity and low-inclusivity playgrounds have 20% of their playgrounds located in areas with income above \$127,385.01. Statistically, there is no significant difference between the median household income of high-inclusive playgrounds and low-inclusive playgrounds.

Table 7: Income Levels of Block Groups and Playgrounds

Income Level	Raleigh Block Groups (n=308)	All Playgrounds (n=76)	25 High Inclusive (n=25)	25 Low Inclusive (n=25)
\$0-\$53,101	71(23.05%)	27(35.53%)	6(24.00%)	10(40.00%)
\$53,101.01 - \$89,947	102(33.12%)	24(31.58%)	11(44.00%)	7(28.00%)
\$89,947.01 - \$127,386	69(22.40%)	11(14.47%)	3(12.00%)	3(12.00%)
\$127,386.01 - \$168,864	48(15.58%)	10(13.16%)	2(8.00%)	5(20.00%)
\$168,864.01 - \$250,001	18(5.84%)	4(5.26%)	3(12.00%)	0(0.00%)

Income levels of Raleigh Block groups, all of the playgrounds, high inclusive playgrounds, and low inclusive playgrounds.

Table 8: Chi-square Regression of Income Levels

Income Level	High Inclusive	Low Inclusive
\$0-\$53,101	6 (7.84) [0.43]	10 (8.16) [0.42]
\$53,101.01 - \$89,947	11 (8.82) [0.54]	7 (9.18) [0.52]
\$89,947.01 - \$127,386	3 (2.94) [0.00]	3 (3.06) [0.00]
\$127,386.01 - \$168,864	2 (3.43) [0.60]	5 (3.57) [0.57]
\$168,864.01 - \$250,001	3 (1.96) [0.55]	1 (2.04) [0.53]

Chi-square regression of income levels between high inclusive playgrounds and low inclusive playgrounds.

Walkability and Public Transit Access

Playgrounds in Raleigh are also assessed for walkability using the Environmental Protection Agency’s walkability index. A majority of playgrounds (33.8%) are located in above-average walkable areas, while 55.9% are in areas with either above-average or average walkability.

Furthermore, 59 parks with playgrounds (76.6%) have at least one GoRaleigh bus stop within a half-mile radius, improving accessibility for residents. Among low-inclusivity playgrounds, 64% are in above-average or most walkable areas, while 52% of high-inclusivity playgrounds are similarly located in highly walkable areas. Only 2 (8.00%) of low-inclusive playgrounds are within least walkable or below average areas, while 8 (32.00%) of high-inclusive playgrounds are considered to be within least walkable or below average areas. 14(56.00%) of low-inclusivity parks have a greenway that is within a half-mile radius. 12(48.00%) of high-inclusivity parks have a greenway that is within a half-mile radius. 22(88.00%) of low-inclusivity parks have at least one bus stop within a half-mile radius, and out of the 22 parks only 18(72.00%) have access to bus stops that are American Disabilities Act compliant. 17(68.00%) of high-inclusivity parks have at least one bus stop within a half-mile radius, and out of the 17 parks, only 10(40.00%) have access to bus stops that are American Disability Act compliant. Additionally, 44 of the 76 playgrounds (57.89%) were located within a half-mile of a greenway.

Table 9: Playground Walkability

	All (n=76)	High Inclusivity (n=25)	Low Inclusivity (n=25)
Least Walkable	7(9.21%)	2(8.00%)	1(4.00%)
Below Average	13(17.11%)	6(24.00%)	1(4.00%)
Average	17(22.37%)	4(16.00%)	7(28.00%)
Above Average	26(34.21%)	11(44.00%)	8(32.00%)
Most Walkable	13(17.11%)	2(8.00%)	8(32.00%)
Access to ADA Bus Stop	42(55.26%)	10(40.00%)	18(72.00%)
Greenway Access	44(57.89%)	12(48.00%)	14(56.00%)

Data for walkability, bus access, and greenway access. N is equal to the number of playgrounds in that category. Percent represents the number of playgrounds in each level divided by the total number of the category of playgrounds. Access to ADA bus stops and greenway access require there to be at least one bus stop or greenway path within a half-mile radius of the playground.

Table 10: Chi-square Regression of Walkability and Transportation

	High Inclusive	Low Inclusive
Least Walkable	2 (1.50) [0.17]	1 (1.50) [0.17]
Below Average	6 (3.50) [1.79]	1 (3.50) [1.79]
Average	4 (5.50) [0.41]	7 (5.50) [0.41]
Above Average	11 (9.50) [0.24]	8 (9.50) [0.24]
Most Walkable	2 (5.00) [1.80]	8 (5.00) [1.80]
ADA Bus Stop	10 (11.41) [0.17]	18 (16.59) [0.12]
Access to Greenway	12 (10.59) [0.19]	14 (15.41) [0.13]

Chi-square of Walkability along with the access to ADA Bus Stop and access to greenways.

Discussion

The findings and framework presented in this study provide valuable insights into the accessibility and inclusivity of playgrounds in Raleigh, North Carolina, particularly for children with disabilities. By integrating spatial analysis, accessibility audits, and demographic data, the research identifies key barriers and opportunities that affect the inclusivity of these recreational spaces. This multifaceted approach helps illuminate disparities in playground accessibility and highlights areas where improvements could enhance equitable access for all children.

Among the findings on walkability, 64% of low-inclusivity parks are located in walkable areas, compared to 52% of high-inclusivity parks. While low-inclusivity parks appear to be in more walkable locations, it is important to note that many of these parks are situated in areas like downtown Raleigh, where lower inclusivity scores are often due to a lack of park equipment, parking options, and facilities. Some of the downtown parks could qualify as pocket parks, they are smaller sized parks with usually less equipment (Zhao et al., 2022). The equipment is usually just a swing, a preschool play area, and a basketball court. Since these parks are also close to downtown, they often lack parking lots with accessible parking options and instead only offer street parking. Many of these parks do not have restroom facilities, and only a few have water drinking fountains. The lack of these elements lowers the PARC score for each playground, making them appear as low-inclusivity parks. These parks were still included in the analysis due to the fact that there is not a set qualification for pocket parks versus regular parks and the City of Raleigh groups them with their regular parks. Though downtown Raleigh offers a walkable area with access to parks, the spaces often lack use for individuals with diverse needs.

Another critical aspect revealed by this study is the role of walkability and public transportation in determining access to inclusive playgrounds. While many playgrounds are located in areas with high walkability scores, several high-inclusivity playgrounds are in less walkable locations. Park users who are in high poverty areas are more likely to walk to parks (Cohen et al., 2012). This presents a potential barrier for families who rely on walking or public transportation to reach playgrounds. Adults with children walk most frequently to parks compared to other locations (Tilt, 2010). Previous research shows that parks in high poverty areas have fewer regular park users but those who used the park regularly lived closer and went more often (Cohen et al., 2012). Although a majority of the playgrounds in Raleigh are near bus

stops, only a fraction of these stops are ADA-compliant, further limiting access for children with disabilities and their caregivers. Enhancing transportation accessibility through the addition of ADA-compliant bus stops near inclusive playgrounds could help bridge this gap and ensure that all children can easily access these spaces.

One of the most significant findings of this research is the geographic and socioeconomic disparity in access to playgrounds. While over half of Raleigh's playgrounds are situated within highly walkable areas and near bus stops, ensuring accessibility in terms of transportation and pedestrian infrastructure, disparities persist when considering economic health indicators. Both low and high-inclusive playgrounds appear to be evenly distributed across different economic health scores, yet a closer analysis reveals that there is a higher concentration of parks in general in healthier economic areas. In general, only 14(18.40%) of all playgrounds are located in less healthy or below average economic areas. 51(67.10%) of all playgrounds are in above average or more healthy economic areas. This pattern aligns with findings from Brindley et al. (2025), who mapped playground provision in the UK and similarly found that access to play spaces tends to be more limited in socioeconomically disadvantaged areas, reinforcing broader spatial and social inequalities.

Only 14 playgrounds (18.40% of all playgrounds) are located within below-average and less healthy areas. There are 38(12.34%) less healthy block groups and 51(16.56%) below-average block groups together they make up 28.90% of the block groups. Of these playgrounds, five are classified as low-inclusive and five as high-inclusive, meaning that only 20.00% of both high and low-inclusive playgrounds are found in neighborhoods with lower economic and health scores. In contrast, 64.00% of high-inclusive playgrounds and 68.00% of low-inclusive playgrounds are located in above-average and more economically healthy areas.

This trend suggests that while playgrounds exist across different socioeconomic conditions, there is a disproportion of playgrounds within more healthy economic areas.

An analysis of the racial distribution around each playground found no statistically significant differences between high-inclusive and low-inclusive sites. However, noticeable patterns in the surrounding racial demographics suggest potential disparities in access to high-quality, inclusive play spaces. Specifically, the number of White, American Indian, Asian, and Hispanic individuals within a half-mile radius is lower around less inclusive playgrounds compared to highly inclusive ones. Conversely, the number of Black individuals within a half-mile radius is higher around low-inclusive playgrounds and lower around high-inclusive playgrounds.

This pattern suggests that predominantly Black communities in Raleigh may have reduced access to highly inclusive playgrounds, which are designed to accommodate a wider range of abilities and provide more accessible and engaging play opportunities. While the study did not find statistically significant differences, these spatial trends align with broader research on racial disparities in access to high-quality public amenities. Within Raleigh, families who are Black are more likely to live near the central business district/downtown, which has smaller playgrounds that are less inclusive - and families who are Whites are more likely to live further from downtown in neighborhoods with inclusive neighborhood parks. Research has shown that neighborhoods with a greater percentage of black residents are on average further from a playground (Arroyo-Johnson et al., 2016).

Additionally, the study highlights differences in playground features that influence their inclusivity. High-inclusivity playgrounds tend to have more diverse play equipment, accessible

pathways, and facilities such as restrooms and water fountains. In contrast, low-inclusivity playgrounds often lack essential accessibility features, including ramps, wheelchair-accessible pathways, and inclusive play structures. This lack of infrastructure creates barriers for children with disabilities, limiting their opportunities for engagement in play. Addressing these disparities through targeted investments in playground renovations and retrofitting could significantly improve accessibility and inclusivity across all playgrounds.

During the analysis of parks, inclusivity was assessed using the PARC (Playground Accessibility Rating Criteria) tool, which evaluates features that contribute to accessibility for individuals with disabilities. Parks were categorized into two groups based on their scores: the 25 highest-scoring parks were classified as high-inclusivity parks, while the 25 lowest-scoring parks were labeled as low-inclusivity parks. This classification aimed to highlight differences in accessibility features across various parks. It is important to note that while inclusivity was assessed using the PARC tool, the PARC tool is biased towards individuals with physical disabilities. Many of the features that are within the audit are features that an individual with physical disabilities would require, items such as: ramps, pathways with no steps, transfer steps, and stable surfaces. Due to the PARC tool having bias towards physical disabilities, it could leave out other disabilities such as sensory processing disorders and cognitive impairments.

One of the most notable findings was the lack of ramps leading to elevated play areas, which significantly impacts accessibility for children who use mobility devices. In preschool play areas, only one park (2.32%) had a ramp leading to an elevated area, while in main play areas, only five parks (6.58%) had such ramps. The limited presence of ramps in preschool play areas may be due to the fact that playground structures designed for younger children tend to be

shorter in height, making ramps less commonly included in the design. However, this absence still poses a barrier for children who rely on mobility aids.

Sensory elements, such as plants or herbs that stimulate the sense of smell, were also found to be lacking in most parks. Only three preschool play areas incorporated plants or herbs intended for sensory stimulation, while only two main play areas included these sensory-friendly features. It is important to note that the audits were conducted in late October and early November, meaning that some seasonal plants may not have been present at the time of assessment. However, the general lack of intentional sensory features highlights a potential improvement in features.

Differentiated ground coloring is an important safety and accessibility feature, helping visually impaired children navigate play spaces more easily and helping children to understand the zones they should stand in to prevent injury or accidents from other kids playing. However, this feature was rarely present. Only five preschool play areas had colored surfaces distinguishing fall zones, and only four main play areas included this feature. The lack of color contrast in fall zones may make it more difficult for children with visual impairments to perceive safe play boundaries.

Outside of play structures, general pathways within the parks were also evaluated for accessibility. Some of the lowest-scoring features included the presence of lighting along main pathways and the availability of handrails on steep inclines. Lighting is essential for safety, particularly for individuals with visual impairments or those visiting the park in low-light conditions. Handrails are equally important for individuals with mobility challenges, yet they were largely absent in most parks. Out of the 76 parks, only 11.84% had lighting along the main

pathways, and there were 2.63% of parks that had handrails for steep areas. Research by Perry et al. (2021) emphasizes that urban parks frequently fall short in accommodating the needs of older adults with disabilities, highlighting deficiencies in accessible amenities, seating, and clear information about park features. These needs are similar to those of families with children with disabilities. The question about the availability of handrails on steep inclines does not take into account the option of there not being any steep inclines within the park.

The analysis of park inclusivity revealed several key areas where improvements could be made to enhance accessibility. While some parks demonstrated strong inclusivity features, many lacked essential elements such as ramps, sensory-friendly components, and clear fall-zone markings. Additionally, general park pathways often failed to include necessary features like lighting, which are crucial for creating an inclusive environment for all visitors.

It is important to highlight that among the high-inclusive playgrounds, none achieved a perfect score. The highest scoring park received 39 out of 54 points due to there not being a preschool area present, equating to a percentage score of 72.22%. This finding highlights that while some of the playgrounds exhibit higher levels of inclusivity, all of the parks have room for improvement. Additionally, there is a high level of variability in scores. While the highest score equates to 72.22%, the lowest score equates to 7.41%. Within Figure 3, the distribution of the PARC scores are shown. The distribution shows insights into the overall quality and accessibility of the 76 parks. The histogram reveals a concentration of scores in the mid-range, with a peak around 50-60%. This suggests that most parks exhibit moderate quality rather than extreme excellence or deficiency. While a few parks score below 20%, indicating potential issues with accessibility, there are also relatively few parks achieving the highest scores, suggesting room for improvement across the board. The spread of scores suggests variability in inclusivity, there is a

lack of a strong skew towards either end of the spectrum. In a similar research paper, it was found that none of the parks within their study group met the criteria for accessibility and usability for people with disabilities (Błaszczuk, M. et al., 2020).

Limitations

Some parks in the City of Raleigh are labeled as having playgrounds, but in certain instances, these playgrounds feature only minimal equipment, such as a single slide or a few swings. These playgrounds could potentially be labeled as pocket parks, which are typically defined by being small public green spaces that are often within urban settings. Research suggests that the effectiveness of pocket parks in encouraging physical activity among children—particularly in diverse communities—is strongly influenced by whether the park is perceived as safe, clean, and attractive (Cohen et al., 2014). The limited availability of play structures restricts the accessibility and engagement opportunities for children of varying abilities, thereby lowering their overall inclusivity score within the PARC tool. As a result, the evaluation may not fully reflect that the needs of children who require more diverse or specialized equipment have an opportunity to participate equally in play. Furthermore, this inconsistency in playground amenities creates challenges in establishing a standardized assessment across all parks.

Another limitation of the study is its exclusive focus on playgrounds owned by the City of Raleigh. This approach potentially overlooks other inclusive playgrounds operated by private organizations, schools, or neighboring municipalities, which could provide additional resources and facilities for children with diverse needs. This study also only focuses on playgrounds and does not take into consideration structured play opportunities such as inclusive sports teams or

other inclusive programming opportunities. By not considering these alternatives, the study might present an incomplete picture of inclusive play opportunities in the area.

Within this thesis, in order to understand the demographic groups surrounding the playgrounds a ½ mile buffer was used. To find the population that is within the ½ mile buffer, the percent of each block group that was within the buffer was multiplied by the total population within each of the respective block groups. So if 50% of a block group was within the buffer, than 50% of the population of the block group would be reported. Since it was not weighted by the actual population distribution, the numbers surrounding the demographics could be slightly skewed.

Additionally, while the study takes into account key factors such as economic health, walkability, and access to public transit, it does not explore other qualitative aspects that could influence inclusivity. For example, community involvement plays a crucial role in maintaining and improving playgrounds, as local engagement can lead to better funding, more inclusive designs, and adaptive programming. Similarly, user satisfaction is an important metric for understanding how well playgrounds serve their intended audiences, yet it is not included in the assessment. Without these additional perspectives, the study may not fully capture the lived experiences of families who rely on these spaces for recreation and social interaction. User satisfaction and use should be further explored to understand the importance of access to inclusive play and whether the space is being used by a diverse population.

Conclusion

The findings of this study highlight the pressing need for further research and targeted policy interventions to enhance the accessibility and inclusivity of playgrounds. While this study

provides an important foundation for understanding disparities in access to inclusive parks, future research should delve deeper into the lived experiences of children with disabilities, their families, and their caregivers. Conducting qualitative studies through interviews, focus groups, and observational research can provide valuable insights into the specific challenges families face when accessing playgrounds, as well as the features that are most beneficial to their children's development and well-being. Moreover, understanding who currently utilizes these spaces—and who may be excluded due to design limitations—can help inform more effective interventions. Data-driven assessments of usage patterns, barriers to access, and community needs will be essential in providing evidence of the need for inclusive play spaces. Resources like the *10-Minute Walk Key Park Equity Policies* report (2023) further emphasize the importance of equitable access to parks and provide policy recommendations that can guide cities in making green spaces, including playgrounds, more accessible and inclusive for all communities.

In addition to further research within Raleigh, it is crucial to replicate this study in other cities and regions to determine whether similar disparities exist elsewhere. The geographic, socioeconomic, and racial distribution of playground accessibility may vary based on urban planning policies, funding priorities, and historical development patterns unique to different communities. By renovating playgrounds to be inclusive in areas that previously lacked access, the City of Raleigh could practice distributive justice, ensuring that resources and opportunities—such as safe and accessible play environments—are fairly allocated across different populations (Grace Episcopal Church, 2021). Beyond equitable distribution, such efforts can also embody substantive justice, by not only aiming for fairness in principle but ensuring real-world, meaningful outcomes that enable all children, including those with

disabilities, to fully participate in public life. Additionally, embracing procedural justice is key: involving community stakeholders—especially those from marginalized or underserved communities—in decision-making processes can ensure that the development and implementation of inclusive playgrounds reflect diverse needs and voices. Conducting comparative studies across multiple municipalities, both urban and rural, can help identify broader systemic trends and inform best practices for inclusive playground development nationwide. Furthermore, investigating how policy changes—such as increased funding for park improvements or new regulations mandating inclusive design—impact playground accessibility over time can provide valuable insights into the effectiveness of different interventions. Another area that could be further explored is the source of funding for park improvements and how this funding affects what is placed within the parks.

By expanding this research to diverse geographic and demographic contexts, policymakers and urban planners can develop more comprehensive strategies to ensure equitable access to high-quality, inclusive play spaces for all children, regardless of their location or background. Ultimately, a national or even global perspective on playground inclusivity will be instrumental in advocating for universal design standards and fostering environments where all children can engage in meaningful and enriching play experiences.

Additionally, fostering collaboration among city planners, policymakers, disability advocates, educators, and community organizations is crucial to ensuring that future playground developments prioritize universal design principles. By integrating accessibility considerations from the earliest stages of planning and allocating adequate funding for inclusive infrastructure, cities can create play environments that are welcoming to all children. Public awareness

campaigns and participatory planning initiatives can further ensure that community voices are heard and reflected in policy decisions.

In conclusion, while Raleigh has made commendable progress in developing inclusive playgrounds, there remain notable disparities in the level of accessibility and inclusivity across different locations. Some playgrounds may offer fully adaptive equipment and sensory-friendly features, while others still lack essential infrastructure to accommodate children of all abilities. By investing in infrastructure improvements, ensuring compliance with universal design principles, and fostering community engagement in the planning process, cities can create truly inclusive play environments. Providing equal access to play not only enhances physical and cognitive development but also fosters social interaction, emotional well-being, and a sense of belonging for all children, regardless of their abilities. Moving forward, prioritizing inclusivity in urban planning will be essential to ensuring that every child has the opportunity to experience the fundamental joy of play.

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