



Investigation of Shade Structures in encouraging more and longer outdoor play during summer in urban childcare

June 2024

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Abstract

This pilot project investigates outdoor play in childcare settings within four Philadelphia's environmental justice neighborhoods. The study aims to address the impact of heat and limited shade on children and staff during the summer months, with a focus on the disparities exacerbated by climate change. Outdoor play is well-established as essential for children's physical, mental, and emotional development, yet heat-exposed neighborhoods face barriers to safe and enjoyable outdoor play. Our primary objective is to determine if the provision of shade structures can increase outdoor playtime during hot months in childcare facilities within these neighborhoods. The study targets Eco-Healthy Childcare facilities participating in the Healthy Childcare Champion program, offering them shade structures and thermometers for data collection. Findings reveal varied effects among the eight centers, with Center 1 showing a 54-minute playtime increase due to shade, while Centers 2, 3, and 8 experienced no noticeable changes due to less flexible scheduling. The presence of shade structures resulted in temperature decreases, with an average 14.2-minute playtime increase and a 5.96-degree temperature reduction across all centers. This underscores the significance of shade structures in enhancing outdoor play and ensuring comfort for children and staff in urban areas facing heat-related challenges.

Introduction

Outdoor play holds a crucial place in early childhood development, offering a range of physical, cognitive, and emotional benefits to children. The American Academy of Pediatrics endorses the significance of outdoor play in promoting motor development, reducing obesity rates, and minimizing the risk of myopia¹. Moreover, exposure to the sun's rays allows for the synthesis of essential vitamin D, contributing to the overall health and vitality of young children. While the merits of outdoor play are indisputable, disparities in the availability of suitable outdoor environments have impacted the experiences of children in urban neighborhoods. This pilot project research study sets its focus on Philadelphia's environmental justice communities, specifically Hunting Park, Strawberry Mansion, Cobbs Creek, and Point Breeze. In the Philadelphia Office of Sustainability's 2017 "Beat the Heat Report," it is noted that Black, Hispanic, and other residents of color are most likely to reside in the hottest neighborhoods, facing not only the challenges of limited green spaces but also the impact of historical inequities like redlining. This leads to an unequal distribution of extreme temperatures, with certain areas recording surface temperatures up to 22°F higher than others². These disparities paint a picture of unequal exposure to extreme heat, highlighting the need to address the issues of climate change not only as a public health concern but also as a matter of racial and social equity. The consequences of these inequities become particularly pronounced in family and center-based childcare settings in the neighborhoods, where outdoor spaces often lack adequate shade from trees and other structures. Through the distribution of shade structures and thermometers, the study seeks to determine if adequate shade in childcare facilities can lead to increased playtime.

Glassy, Danette, and Pooja Tandon. "Playing Outside: Why It's Important for Kids." *HealthyChildren.org*, 19 April 2023, <https://www.healthychildren.org/English/family-life/power-of-play/Pages/playing-outside-why-its-important-for-kids.aspx>.

Juliano, Tony. "Beat the Heat Hunting Park." *Phila.gov*, 19 July 2019, https://www.phila.gov/media/20190719092954/HP_R8print-1.pdf.

¹ Glassy and Tandon, 2023

² Juliano, 2019

Project Aims

1. Determining the degrees of heat contributing to childcare play in vulnerable neighborhoods.
2. Amount of time staff and children will be outside for play if shade is available.
3. Temperature differences in the shade v. direct sun in Philadelphia neighborhoods.
4. Understanding the Air Quality Index (AQI) and adjusting outdoor play when air quality is unsafe.

Methodology

Study Design

This pilot research project employed a mixed-methods approach to investigate the impact of shade structures on outdoor playtime and temperature in eight childcare centers situated in heat-vulnerable neighborhoods in Philadelphia. The study ran from July 27 to August 25, 2023. Most participants participated for three weeks. Pop-Up Canopy Tents and thermometers were purchased and sent to the chosen childcare facilities. The project team assisted in initial installation and continued communication through check-ins. The study consisted of site visits, phone calls, and daily form submissions. Participants submitted daily electronic forms, including play times, children's age and number demographic, staffing, thermometer readings, AQI, and possible daily schedule changes. WHE staff reviewed and updated data daily to each provider research sheet.

During Week 1 of the study, providers recorded the start and end times of the children's playtime and surface temperature. This week was referred to as the baseline, during which providers measured the normal conditions without a shade structure. In Weeks 2 and 3, they continued to measure the same data, and they also recorded the surface temperature under the canopy.

Participant Selection

Recruited participants were identified from childcare facilities already enrolled in WHE's Healthy Childcare Champion program in the targeted environmental justice neighborhoods. The key criterion for participant selection was the absence of shade protection in their outdoor play areas, thereby establishing the need for intervention. All participation in the project was voluntary.

Instruments for Data Collection

Each provider received a canopy based on the preferred size and feasibility with their outdoor space, here are the four structures that were available:

- 1) Cobizi 10x20 (<https://shorturl.at/JLZ23>)
- 2) Crown Shades 10x10 (<https://shorturl.at/fkmoM>)
- 3) Coleman 10x10 (<https://shorturl.at/dlqAF>)
- 4) Quictent 8x8 (<https://shorturl.at/afIR1>)
- 5) AsterOutdoor (<https://shorturl.at/wBEG2>)

Including the shade structures, providers were given Taylor Thermometers (<https://shorturl.at/tMTU9>). The thermometers are digital indoor/outdoor thermometers that have a 10-foot wired probe which allows accurate temperature readings of the ground surface level.

Distributed to each participant were electronic “Daily Provider Log Forms” (See Appendix A) which had to be sent to the WHE staff before midnight of the participating day. The electronic forms asked:

- A) Date
- B) Staffing and facility information
- C) Playtime
 - a. Start
 - i. What time did you start playtime? (If multiple, please include all times separated by a COMMA)
 - b. End
 - i. What time did you end play time? (If multiple, please include all times separated by a COMMA)
- D) Age group of children at play and number
 - a. Infant
 - b. Toddler
 - c. Preschool
- E) Number of staffing supervising play
- F) Thermometer readings
 - a. In-direct sunlight (Weeks 1-3)
 - b. Under shade (Week 2, 3)
- G) AQI Reading for the day
 - a. Color
 - b. Number
- H) Issues with shade structures, any changes in daily schedule that impacted playtime schedule
 - a. Rain day
 - b. Temperature
 - c. AQI reading

Data Handling

All recorded data was transmitted daily through the Daily Provider Log form to the WHE staff. The data underwent a manual review and was entered into individual provider logs, each tracking all received data per participant. After the study, a set of computations was performed to derive sums and averages. Utilizing the collected dataset, we computed both playtime averages with and without shade and calculated the total difference in playtime. Additionally, the average surface temperature differential between the two conditions and the reduction in surface temperature were determined.

Results

Data from the eight childcare facilities were reviewed to compare the differences in surface temperature between shaded and unshaded areas and the changes in playtime associated with the structure's presence.

Surface Temperature and Shade

HP1:

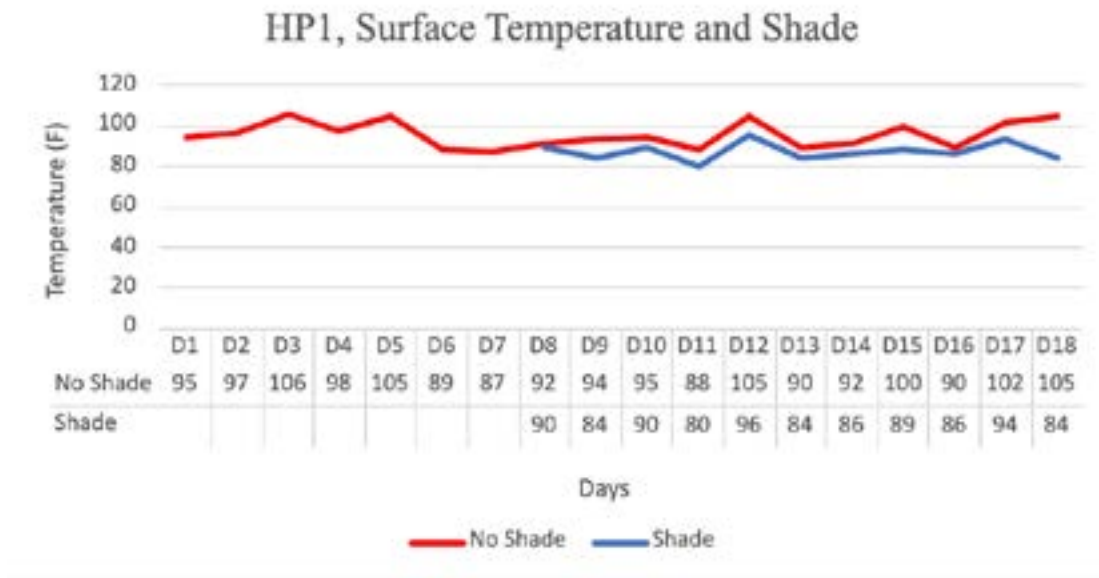


Table 1.0

Averages	Temperatures (°F)
Avg Temp with No Shade	96.11
Avg Temp with Shade	87.55
Avg Temp Difference	8.57

Table 1.1

At Childcare Facility HP1, the recorded surface temperatures for children exposed to direct sunlight, without shade, showed variation over the 18-day observation period, ranging from 87°F to 106°F. The average temperature without shade was 96.11°F. In contrast, children under the shade structure experienced a more consistent and lower temperature range, with values ranging from 80°F to 96°F. The average temperature under the shade was 87.55°F. Consequently, the average temperature difference between the two conditions was calculated to be 8.57°F.

HP2:

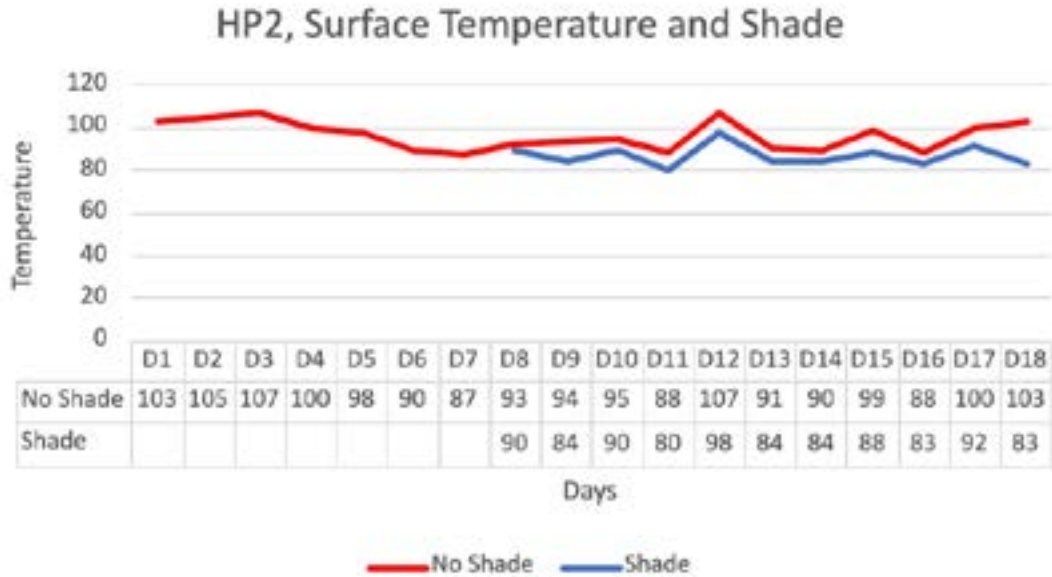


Table 2.0

Averages	Temperatures (°F)
Avg Temp with No Shade	96.55
Avg Temp with Shade	86.91
Avg Temp Difference	9.65

Table 2.1

At Childcare Facility HP2, the recorded surface temperatures for children exposed to direct sunlight, without shade, showed variation over the 18-day observation period, ranging from 87°F to 107°F. The average temperature without shade was 96.55°F. In contrast, children under the shade structure experienced a more consistent and lower temperature range, with values ranging from 80°F to 98°F. The average temperature under the shade was 86.91°F. Consequently, the average temperature difference between the two conditions was calculated to be 9.65°F.

SM1:

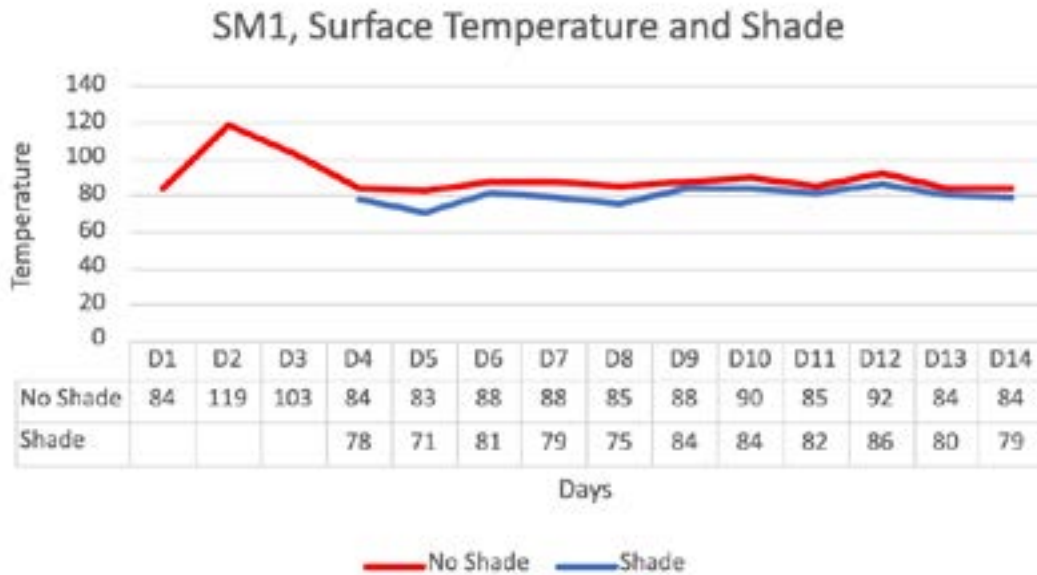


Table 3.0

Averages	Temperatures (°F)
Avg Temp with No Shade	89.79
Avg Temp with Shade	79.91
Avg Temp Difference	9.88

Table 3.1

At Childcare Facility SM1, the recorded surface temperatures for children exposed to direct sunlight, without shade, showed variation over the 14-day observation period, ranging from 83°F to 119°F. The average temperature without shade was 89.79°F. In contrast, children under the shade structure experienced a more consistent and lower temperature range, with values ranging from 71°F to 86°F. The average temperature under the shade was 79.91°F. Consequently, the average temperature difference between the two conditions was calculated to be 9.88°F.

SM2:

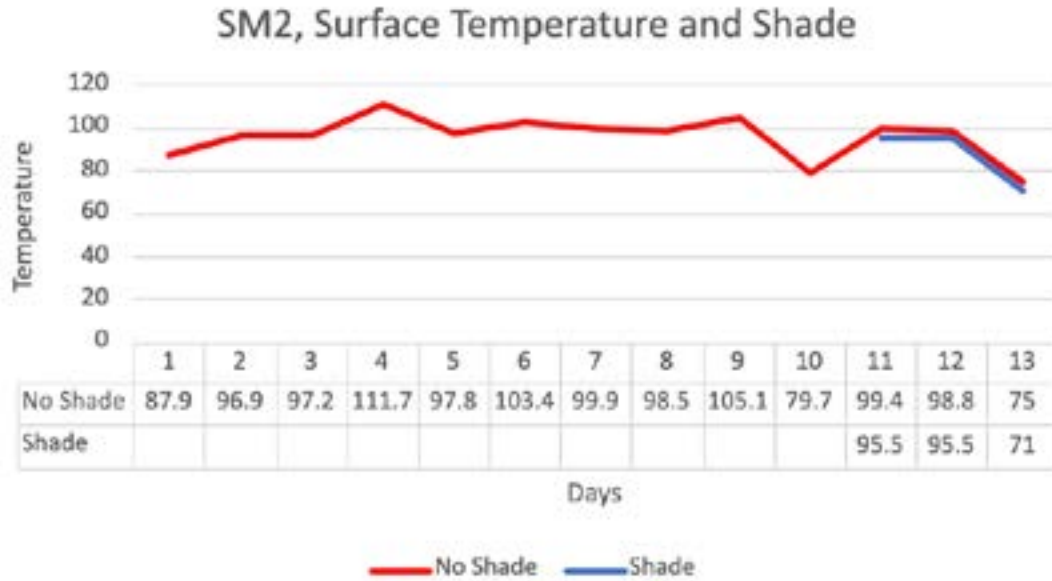


Table 4.0

Averages	Temperatures (°F)
Avg Temp with No Shade	96.25
Avg Temp with Shade	87.33
Avg Temp Difference	8.92

Table 4.1

At Childcare Facility SM2, the recorded surface temperatures for children exposed to direct sunlight, without shade, showed variation over the 13-day observation period, ranging from 75°F to 111.7°F. The average temperature without shade was 96.25°F. In contrast, children under the shade structure experienced a more consistent and lower temperature range, with values ranging from 71°F to 95.5°F. The average temperature under the shade was 87.33°F. Consequently, the average temperature difference between the two conditions was calculated to be 8.92°F.

PB1:

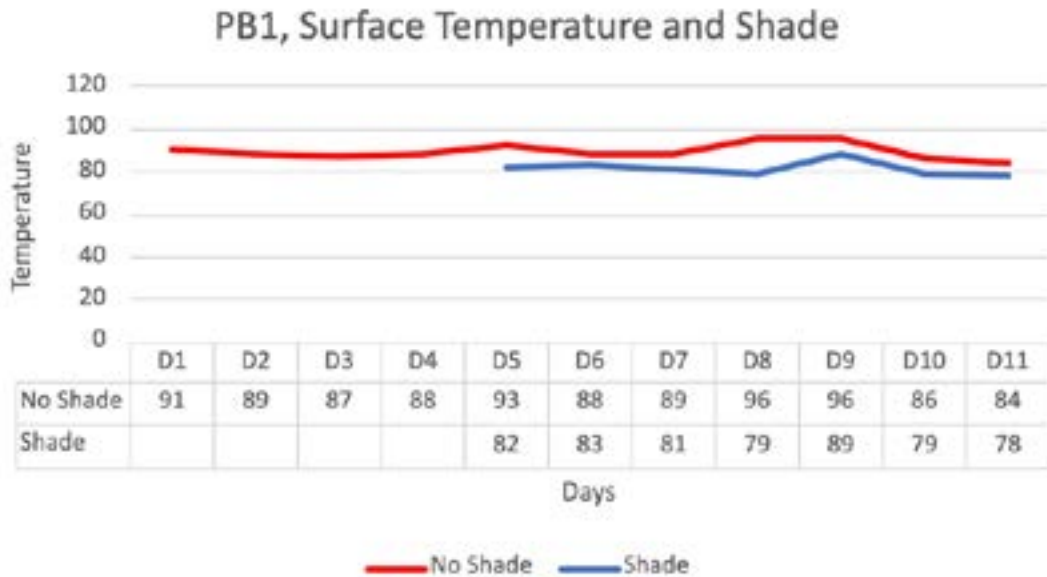


Table 5.0

Averages	Temperatures (°F)
Avg Temp with No Shade	89.73
Avg Temp with Shade	81.57
Avg Temp Difference	8.16

Table 5.1

At Childcare Facility PB1, the recorded surface temperatures for children exposed to direct sunlight, without shade, showed variation over the 11-day observation period, ranging from 84°F to 96°F. The average temperature without shade was 89.73°F. In contrast, children under the shade structure experienced a more consistent and lower temperature range, with values ranging from 78°F to 89°F. The average temperature under the shade was 81.57°F. Consequently, the average temperature difference between the two conditions was calculated to be 8.16°F.

PB2:

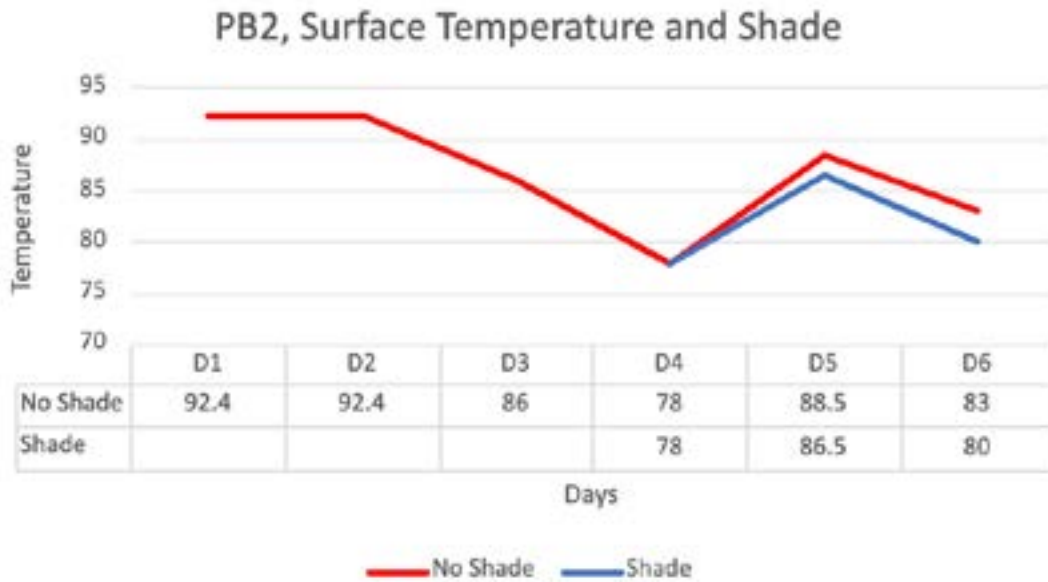


Table 6.0

Averages	Temperatures (°F)
Avg Temp with No Shade	86.72
Avg Temp with Shade	81.5
Avg Temp Difference	5.22

Table 6.1

At Childcare Facility PB2, the recorded surface temperatures for children exposed to direct sunlight, without shade, showed variation over the 6-day observation period, ranging from 78°F to 92.4°F. The average temperature without shade was 86.72°F. In contrast, children under the shade structure experienced a more consistent and lower temperature range, with values ranging from 78°F to 86.5°F. The average temperature under the shade was 81.5°F. Consequently, the average temperature difference between the two conditions was calculated to be 5.22°F.

CC1:

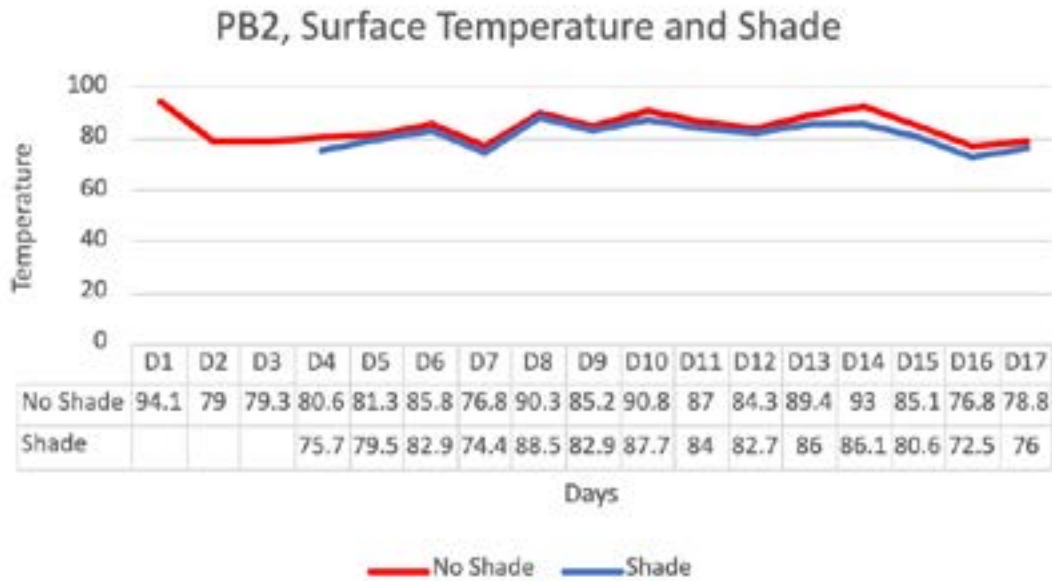


Table 7.0

Averages	Temperatures (°F)
Avg Temp with No Shade	84.56
Avg Temp with Shade	81.39
Avg Temp Difference	3.17

Table 7.1

At Childcare Facility CC1, the recorded surface temperatures for children exposed to direct sunlight, without shade, showed variation over the 17-day observation period, ranging from 76.8°F to 94.1°F. The average temperature without shade was 84.56°F. In contrast, children under the shade structure experienced a more consistent and lower temperature range, with values ranging from 72.5°F to 88.5°F. The average temperature under the shade was 81.39°F. Consequently, the average temperature difference between the two conditions was calculated to be 3.17°F.

Average Playtime and Shade

HP1:

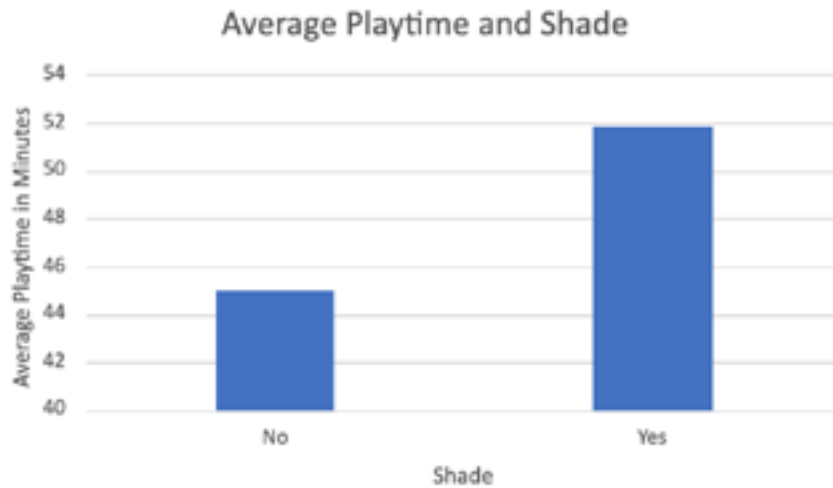


Table 1.2

During the observation period, children played outside without shade for an average of 45 minutes over 7 days, whereas their playtime extended to an average of 51.82 minutes during 10 days under the shade structure. Thus, there was an increase in playtime by 6.82 minutes when the shade structure was present.

HP2:

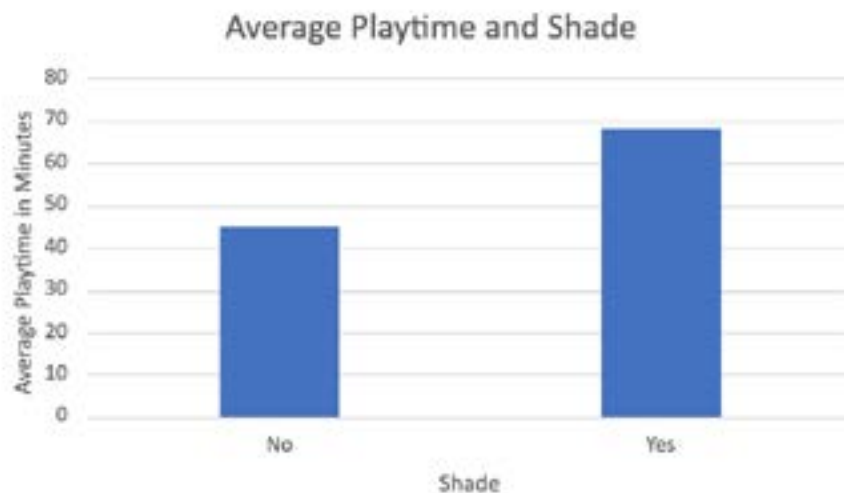


Table 2.2

During the observation period, children played outside without shade for an average of 45 minutes over 7 days, whereas their playtime extended to an average of 68.18 minutes during 10 days under the shade structure. Thus, there was an increase in playtime by 23.18 minutes when the shade structure was present.

HP2:

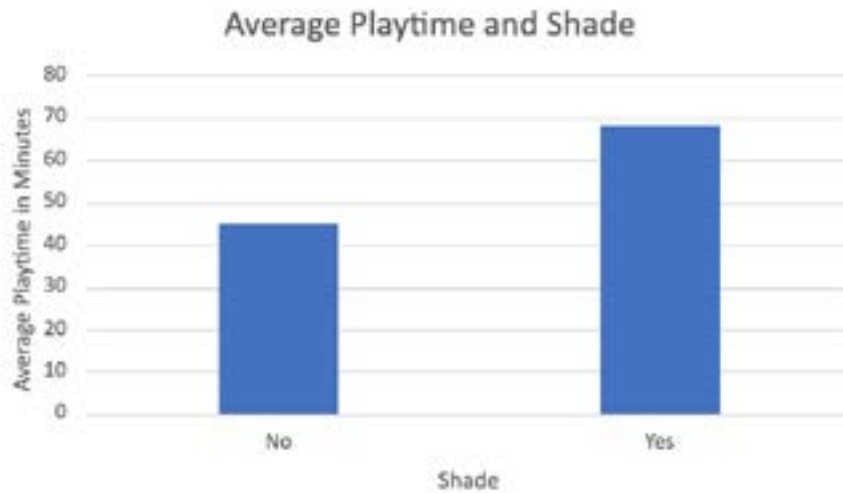


Table 2.2

During the observation period, children played outside without shade for an average of 45 minutes over 7 days, whereas their playtime extended to an average of 68.18 minutes during 10 days under the shade structure. Thus, there was an increase in playtime by 23.18 minutes when the shade structure was present.

SM1:

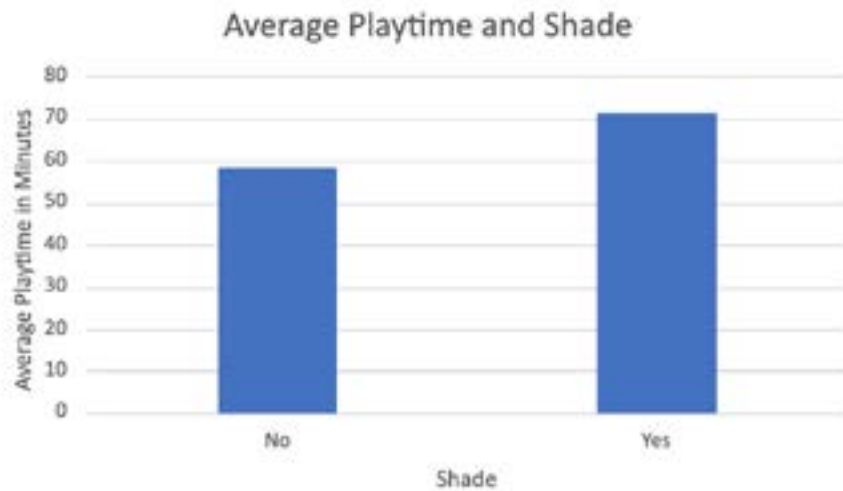


Table 3.2

During the observation period, children played outside without shade for an average of 58.33 minutes over 3 days, whereas their playtime extended to an average of 71.36 minutes during 10 days under the shade structure. Thus, there was an increase in playtime by 13.03 minutes when the shade structure was present.

SM2:

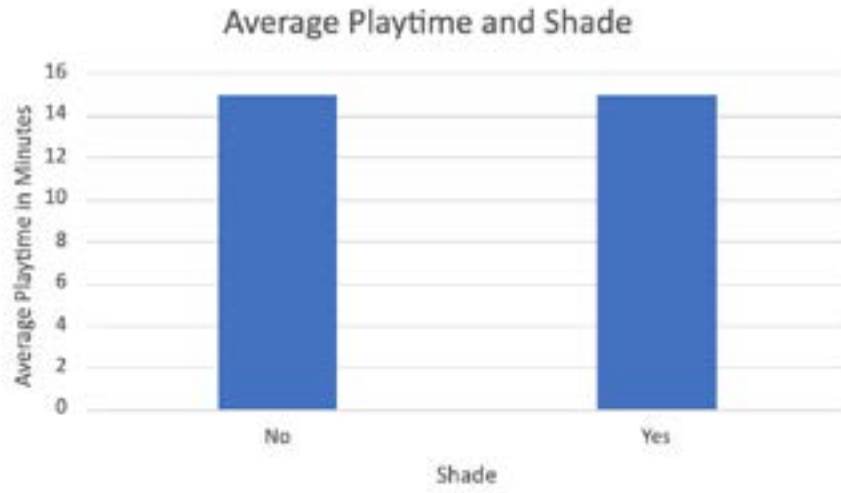


Table 4.2

During the observation period, children played outside without shade and for an average of 15 minutes over 13 days. Thus, there was no change in playtime when the shade structure was present.

PB1:

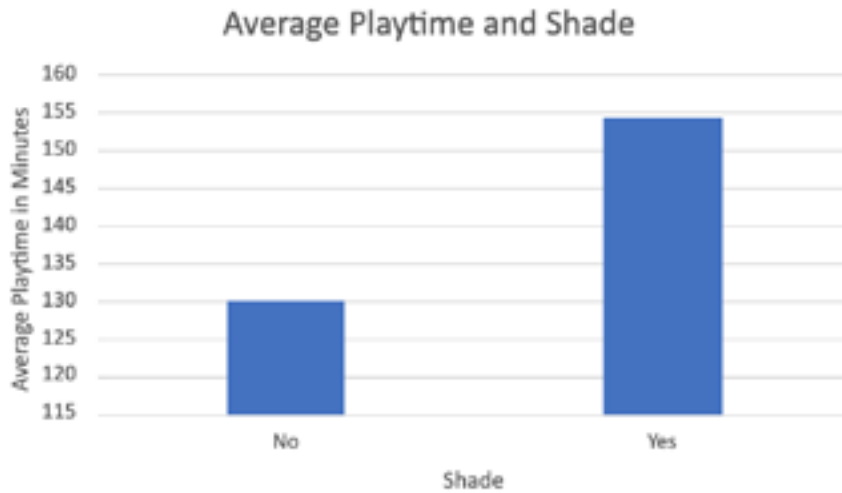


Table 5.2

During the observation period, children played outside without shade for an average of 130 minutes over 4 days, whereas their playtime extended to an average of 154.29 minutes during 7 days under the shade structure. Thus, there was an increase in playtime by 24.29 minutes when the shade structure was present.

PB2:

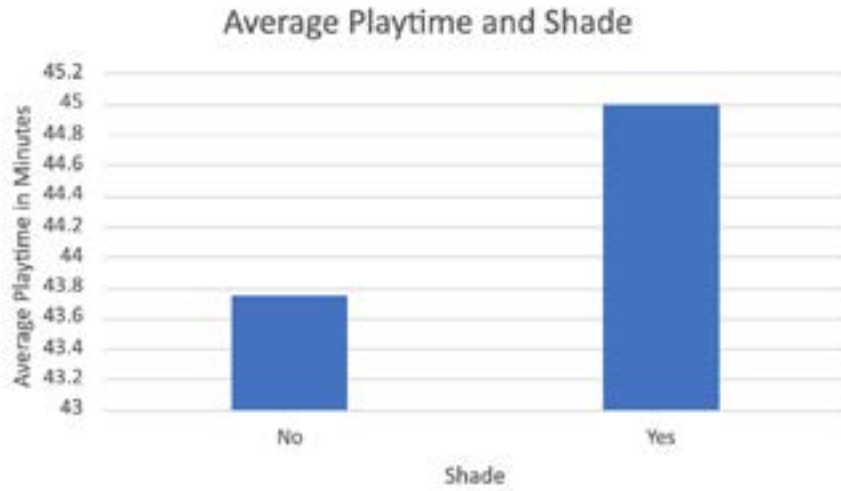


Table 6.2

During the observation period, children played outside without shade for an average of 43.75 minutes over 3 days, whereas their playtime extended to an average of 45 minutes during 3 days under the shade structure. Thus, there was an increase in playtime by 1.25 minutes when the shade structure was present.

CC1:

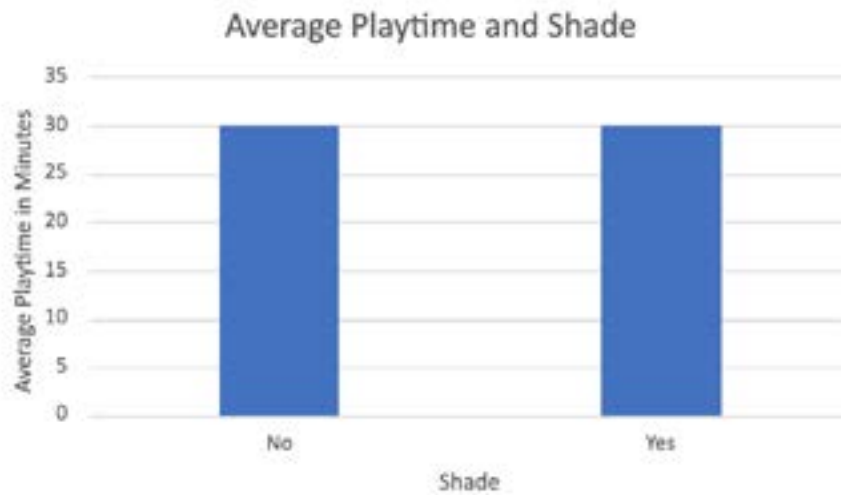


Table 7.2

During the observation period, children played outside without shade and for an average of 30 minutes over 17 days. Thus, there was no change in playtime when the shade structure was present.

Discussion

The results obtained from the childcare facilities involved in this pilot project provide insights into the influence of shade structures on surface temperatures and outdoor playtime. We will discuss the findings from each participant (HP1, HP2, SM1, SM2, PB1, PB2, CC1) individually before summarizing the overall implications of the study.

Participant HP1 experienced varying surface temperatures over an 18-day period, with a recorded range of 87°F to 106°F and an average temperature of 96.11°F. Conversely, children under the shade structure benefited from lower temperatures (ranging from 80°F to 96°F) with an average of 87.55°F, resulting in an average temperature difference of 8.57°F. Furthermore, the follow-up interview indicated that the shade structure enhanced children's comfort, leading to an increased playtime of 6.82 minutes on average. However, the interview also highlighted the need to control factors such as the time of day for temperature measurements to improve accuracy.

Similarly, Participant HP2 observed temperature variations between the two conditions, with average temperatures of 96.55°F without shade and 86.91°F under the shade structure, resulting in an average temperature difference of 9.65°F. The interview reinforced the positive impact of the shade structure on comfort and playtime, indicating an extension of 23.18 minutes on average. These findings underscore the consistent cooling effect of the shade structure at Childcare Facility HP2.

Participant SM1's data exhibited temperature variations with surface temperatures ranging from 119°F to 83°F without shade and an average of 89.79°F. Under the shade structure, temperatures ranged from 71°F to 86°F with an average of 79.91°F, resulting in an average temperature difference of 9.88°F. Children at this facility experienced an extended playtime of 13.03 minutes on average. The interview also emphasized the positive experiences with the shade structure, despite a temporary disruption caused by weather, wind and storms.

Participant SM2's data illustrated temperature variations between the conditions, with an average temperature of 96.25°F without shade and 87.33°F under the shade, resulting in an average temperature difference of 8.92°F. However, playtime did not change significantly between the two conditions, remaining at an average of 15 minutes. The interview revealed that the structure contributed to children's comfort, although the daily outdoor schedule limited playtime variation.

Participant PB1 recorded average temperatures of 89.73°F without shade and 81.57°F under the shade structure, reflecting an average temperature difference of 8.16°F. The extended playtime of 24.29 minutes under the shade structure emphasized its favorable impact.

Participant PB2's data showed temperature variations, with an average temperature of 86.72°F without shade and 81.5°F under the shade structure, resulting in an average temperature difference of 5.22°F. While the playtime increased slightly by 1.25 minutes with the shade structure, it remained relatively consistent.

Lastly, Participant CC1's data exhibited temperature variations, with average temperatures of 84.56°F without shade and 81.39°F under the shade structure, resulting in an average temperature difference of 3.17°F. The playtime remained constant, indicating no change due to an already-established outdoor schedule.

The presence of shade structures resulted in temperature decreases, with an average 14.2-minute playtime increase and a 5.96-degree temperature reduction across all centers.

Overall, these results highlight the cooling benefits of shade structures, with temperature differentials ranging from 3.17°F to 9.88°F, as well as positive experiences with increased comfort and playtime for children. However, the impact on playtime varied among participants and depended on existing outdoor schedules. The need to control factors like the time of day for temperature measurements should be considered in future studies. These findings support the potential of shade structures to create a more comfortable and enjoyable outdoor environment for children, with implications for their well-being and outdoor engagement. Further research can delve into factors influencing these outcomes, such as local climate conditions, wind, and scheduling, to refine our understanding of the relationship between shade and outdoor activities.

Bias and Limitations

The study acknowledges biases and limitations that may impact the interpretation of results. Firstly, participants were selected from childcare facilities already enrolled in the Healthy Childcare Champion program. This decision was made to recruit participants who would be receptive towards the program and the constant communication with the WHE staff. Additionally, the study faced challenges related to compliance, with variations in the duration of data collection among providers. While efforts were made to ensure consistent reporting, factors such as personal provider workload, unexpected weather disruptions and participant scheduling constraints led to inconsistencies. The variability in the number of observation days for each provider poses a challenge in drawing generalized conclusions. Despite these limitations, the study provides valuable insights into the impact of shade structures on outdoor play in urban childcare settings, serving as a foundational step for future research in this crucial area.

Conclusion

In conclusion, this pilot project sheds light on the role of shade structures in mitigating the effects of heat on outdoor playtime for children in four Philadelphia's environmental justice neighborhoods. The study demonstrates that the introduction of shade structures led to a reduction in surface temperatures, creating a more comfortable environment for both children and staff. Notably, the association between shade presence and increased playtime suggests that addressing the lack of shade can enhance outdoor experiences in childcare settings.

Moving forward, there is an opportunity for institutions to delve deeper into the dermatological impacts of prolonged sun exposure on children in these communities. Examining skin health, sunburn occurrences, and other dermatological factors could provide a comprehensive understanding of the broader implications of limited shade in outdoor environments.

Furthermore, the success of this pilot project warrants consideration for its expansion to encompass other open environmental spaces in environmental justice communities where children grow, play, and live. This broader scope would allow for an examination of the impact of shade structures on outdoor spaces beyond childcare facilities, potentially influencing urban planning and policy initiatives. The data collected in this pilot study forms a foundation for future research initiatives that aim to create more equitable and health-promoting outdoor environments for children in vulnerable communities.

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Recommendations

1. Set up shade structures early in the spring.
2. Check the Air Quality Index (AQI) daily to ensure safe outdoor air quality for children using AirNow.Gov.
3. Utilize surface temperature thermometers to record outdoor concrete temperatures.
4. If your schedule permits, be flexible with outdoor playtime to avoid high heat times.
5. Wear sun-protective clothing and accessories such as hats and sunglasses.
6. Use a screen with an SPF of 30 or higher.
7. Stay hydrated with water when outdoors.
8. During the planning of urban tree cover projects, the addition of shade structures must be included to provide immediate relief from excessive temperatures especially to protect young children in Environmental Justices neighborhoods.

Appendix A

Shade Structure, Childcare Daily Log

Women For a Healthy Environment
Healthy Childcare Champions

* Required

1. Today's date

Please input date (M/d/yyyy)



2. Center Name

Enter your answer

3. Full name

Completing this form

Enter your answer

4. Phone number

The value must be a number

5. Email address

Enter your answer

6. Start Time

What time did you start play time? (If multiple, please include all times separated by a COMMA)

Enter your answer

7. End Time

What time did you end play time? (If multiple, please include all times separated by a COMMA)

Enter your answer

8. Children outside at play

Select all that apply

- Infant
- Toddler
- Preschool

9. INFANTS: Number of children outside during play

Only report the number of infants

Enter your answer

10. TODDLERS: Number of children outside during play

Only report the number of toddlers

Enter your answer

11. **PRESCHOOL: Number of children outside during play**

Only report the number of preschool children

Enter your answer

12. **Number of staff outside during play**

Enter your answer

13. **Thermometer reading, IN DIRECT SUN ***

Measured for weeks 1, 2, & 3

Enter your answer

14. **Thermometer reading, UNDER OF THE SHADE ***

Measured for weeks 2 & 3

Enter your answer

15. **AQI for the day? ***

Color, Number

Enter your answer

16. Please report any issues with the shade structures here, if any *

Enter your answer

17. Any changes in daily schedule or events which might influence the playtime today? *

Rain day

Temperature

AQI

Other

Submit

Never give out your password. [Report abuse](#)