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Abstract

This study describes the process evaluation of the *Supporting Physical Activity in the Childcare Environment (SPACE)* intervention, consisting of educator physical activity training, provision of portable play equipment, and a modified outdoor schedule (i.e., 4 × 30-minute periods). Educators ($N = 49$) from 11 childcare centers in London, Ontario, Canada, delivered the 8-week intervention to 200 preschoolers ($M_{\text{age}} = 3.38$ years). Workshop attendance was documented while adherence to the outdoor schedule and number and timing of outdoor sessions offered (i.e., dose) were recorded in a daily log. Questionnaire-based program evaluation ($n = 41$) and in-person group interviews ($n = 7$) were completed postintervention to assess educator perspectives on the barriers and facilitators to implementation (i.e., context), the feasibility and perceived effectiveness of the intervention, educator and preschooler enjoyment, communication among researchers and childcare personnel, and the future implementation of the intervention. Descriptive statistics were calculated, and responses to open-ended questions were inductively coded. Educator workshop attendance was 96%, and 88% of classrooms adhered to the four daily outdoor periods. Educators delivered 90% of the scheduled outdoor sessions, and 87% of these met the 30-minute criteria. Educators expressed that the increase in number of transitions made the outdoor playtimes challenging to implement, yet rated the feasibility of the training and equipment as high. Educators perceived the intervention to be both enjoyable and effective at increasing preschoolers' physical activity. They indicated effective communication and revealed that they intended to continue to use their physical activity knowledge and to offer the play equipment once the intervention had concluded. These findings demonstrate that the SPACE intervention is viable in center-based childcare.

Keywords

childcare, intervention, outdoor play, physical activity, preschoolers, process evaluation

Impact statement

In addition to successfully improving the physical activity of preschoolers during childcare hours (Tucker et al., 2017), the SPACE intervention was implemented as intended and regarded as feasible within the context of center-based childcare, thereby emphasizing the role of education, portable play equipment, and, most importantly, shorter, more frequent outdoor playtimes in promoting young children's physical activity.

Introduction

To address the low levels of physical activity exhibited among young children worldwide, a number of complex

physical activity interventions have transpired in the childcare setting, with varying degrees of effectiveness (De Bock, Genser, Raat, Fischer, & Renz-Polster, 2013; De Craemer et al., 2014; Finch et al., 2014; Goldfield et al., 2016; Jones, Okely, Hinkley, Batterham, & Burke, 2016; Pate et al., 2016). The success of childcare interventions may vary based on the

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level of implementation (i.e., intervention adherence; Durlak & DuPre, 2008). Process evaluations, including assessment of the extent of program delivery, can be used to improve our understanding of childcare-targeted physical activity intervention outcomes (Saunders, Evans, & Joshi, 2005). To date, few formal process evaluations have been conducted to examine such outcomes (Alhassan & Whitt-Glover, 2014; Androustos et al., 2014; Kennedy, Schenkelberg, Moyer, Pate, & Saunders, 2017; Saunders et al., 2017; Trost, Fees, & Dziewaltowski, 2008).

Process evaluations incorporate “any combination of measurements obtained during the implementation of a program to control, assure, or improve the quality of performance and delivery” (McKenzie, Neiger, & Thackeray, 2009, p. 339). While some researchers have recommended that specific factors be considered when evaluating implementation of an intervention, such as fidelity (i.e., adherence), dose delivered, dose received, reach, context, and recruitment (Durlak & DuPre, 2008; Saunders et al., 2005), others have emphasized that process evaluations should be designed to reflect the unique outcomes and characteristics of the intervention being assessed (Grant, Treweek, Dreischulte, Foy, & Guthrie, 2013).

Considering the available evidence summarizing the effective components of previous childcare physical activity interventions (Gordon, Tucker, Burke, & Carron, 2013), the *Supporting Physical Activity in the Childcare Environment* (SPACE) study aimed to increase the physical activity levels and decrease the sedentary time of preschoolers enrolled in these settings (Tucker et al., 2016; Tucker et al., 2017). The SPACE study included a multicomponent, evidence-based physical activity intervention that included three components: (a) educator training, (b) environmental modifications by way of the addition of portable play equipment, and (c) a revised daily outdoor playtime schedule (Tucker et al., 2016). Preschoolers' ($n = 338$) physical activity was measured using Actical™ accelerometers. The SPACE intervention was found to be effective at improving moderate-to-vigorous physical activity (MVPA) and total physical activity (TPA), and decreasing sedentary time during childcare hours from pre- to postintervention (Tucker et al., 2017). However, the effects were not sustained at 6 and 12 months postintervention (Tucker et al., 2017). The purpose of the present study was to conduct a process evaluation of the SPACE intervention to understand the quality and extent of intervention implementation.

Method

Evaluation Components

Grounded in the PRECEDE-PROCEED model for health promotion program planning (Green & Kreuter, 2005), a process evaluation plan was created and tools were developed to assess attendance, adherence, dose delivered,

context, feasibility, perceived effectiveness, enjoyment, communication, and future implementation of the SPACE intervention. Specifically, educator *attendance* at a training session and the extent to which the modified outdoor schedule was implemented as intended (i.e., *adherence*) were examined, along with the number and timing of outdoor sessions offered to preschoolers (i.e., *dose delivered*), and the barriers and facilitators related to implementation (i.e., *context*; environmental factors that may influence program delivery; McKenzie et al., 2009). The *feasibility* of the SPACE intervention within the childcare setting was also investigated in conjunction with educator perceptions of its *effectiveness* at improving preschoolers' activity levels, educator *enjoyment*, as well as preschooler enjoyment of it. The effectiveness of *communication* among the research team and childcare personnel was also assessed. Finally, educators' anticipated *future implementation* of intervention components and suggestions for improvement were explored.

Study Design and Intervention Description

The SPACE study, a single-blind cluster randomized controlled trial, included 22 childcare centers in London, Ontario, Canada. While randomly assigned control centers ($n = 11$) maintained their typical curriculum throughout the study, the 8-week intervention was implemented in experimental centers ($n = 11$) during the spring/summer of 2015. The SPACE intervention was composed of (a) *physical activity-related training for childcare educators*, including one 4-hour workshop (offered prior to or within the first week of the intervention commencing); (b) *environmental modifications*, which included the introduction of new portable play equipment (e.g., hula hoops, balls, hop-along bouncers); and (c) a *modified curriculum*, which involved the restructuring of daily outdoor playtime from the two 60-minute outdoor periods required in Ontario childcare centers (Vanderloo, Tucker, Ismail, & van Zandvoort, 2012) to a new schedule consisting of four 30-minute outdoor periods. A single visit from a physical activity instructor was also provided to preschoolers in participating classrooms to help promote and elicit educators' ideas to encourage indoor physical activity. Further details of the intervention components and study methodology are published elsewhere (Tucker et al., 2016). The research ethics board at the University of Western Ontario granted approval for the SPACE study (REB # 105779), and it was assigned an International Standard Randomized Controlled Trial Number (ISRCTN70604107).

Participants

Educators who were fluent in English and provided care to children (ages 2.5–4 years) in preschool classrooms within enrolled centers were eligible to participate. Preschooler and childcare characteristics, recruitment, and retention rates for

the SPACE study have been reported previously (Tucker et al., 2016; Tucker et al., 2017). For the purpose of the current study, only educators who worked in childcare centers assigned to the experimental condition (i.e., those who delivered the intervention) were included.

Protocol for SPACE Intervention Delivery

With support from the childcare director and project coordinator associated with the research project, childcare educators were responsible for delivering the SPACE intervention to preschoolers in their center. Educators were required to attend one physical activity training workshop, to provide access to and regularly rotate the supplied portable play equipment during each outdoor period, and to ensure that children within participating classrooms received four 30-minute unstructured outdoor playtimes every day for 8 weeks. Educators were given autonomy to rotate the equipment at their discretion to encourage children's engagement, and to adapt the daily schedule to incorporate the four outdoor periods into the existing curriculum (e.g., they could choose to schedule three outdoor periods in the morning and one in the afternoon, or two in the morning and two in the afternoon). Frequent site visits by the project coordinator prior to and throughout the intervention implementation provided support to childcare personnel to promote adherence to the protocol (Durlak & DuPre, 2008).

Tools

Demographic Questionnaire. A demographic questionnaire was administered to collect information pertaining to participating educators' age, sex, ethnicity, years of work experience in the childcare setting, employment status, and highest level of education attained.

Daily Outdoor Log. Educators were asked to keep a daily record of the number and timing of outdoor play periods for the duration of the 8-week intervention. If outdoor play was not possible, educators were asked to indicate the reason (i.e., weather, field trip, educator-to-child ratios, or other). Verbal instructions for completing the outdoor log were provided to educators during distribution, which occurred in each participating classroom after baseline measures, yet prior to the start of the intervention. Written instructions were included with the log to remind educators how to accurately report information. Logs were collected after the intervention had ended, and postintervention measures were complete.

Program Evaluation Questionnaire. Developed for the purpose of this study, and administered postintervention (i.e., week 8) to educators in the experimental group only, this 19-item questionnaire assessed educators' perspectives on the intervention, including feasibility (i.e., how easy it was to

implement the intervention; 6 items); perceived effectiveness (i.e., how effective the intervention was perceived to be at improving preschoolers' physical activity; 4 items); and both preschooler and educator enjoyment (i.e., how much the children liked the intervention; 3 items; and how much educators enjoyed the intervention themselves; 4 items). Responses were rated on a 5-point Likert-type scale from 1 (*strongly disagree, not at all effective, not at all enjoyable*) to 5 (*strongly agree, extremely effective, extremely enjoyable*). The likelihood of future implementation of each component of the intervention (4 items) was also evaluated on a 5-point Likert-type scale from 1 (*not at all likely*) to 5 (*extremely likely*). The tool further aimed to explore the effectiveness of communication among researchers, center directors, and educators (2 items) on a 5-point Likert-type scale from 1 (*not at all effective*) to 5 (*extremely effective*). Finally, educators were asked to complete three open-ended questions assessing their overall experience in delivering the intervention, challenges faced, and solutions used to overcome noted barriers.

Educator Interviews. During the physical activity workshop hosted at the start of the intervention period, educators were invited to indicate their interest in being contacted to participate in postintervention face-to-face interviews. After the intervention had ceased, those who had indicated an interest in participating were contacted. Individual and small group interviews (1-4 participants) were conducted with consenting educators who delivered the SPACE intervention. A semistructured interview guide was used (Patton, 2002) to gauge the following educator attitudes: initial level of interest, overall experience in delivering the intervention, perspectives regarding the individual intervention components, and perceptions of effectiveness of the intervention at increasing preschoolers' physical activity levels. Educators were also asked to describe their thoughts on the feasibility of implementing the intervention, the challenges they faced, the solutions they employed, and suggestions to improve implementation. Interviews with educators took place outside of childcare hours and were approximately 1 hour in duration. An experienced moderator conducted the interviews, and an assistant moderator was present to summarize participant comments. Interviews were audio-recorded and transcribed verbatim. To help ensure data trustworthiness, the moderator and assistant moderator debriefed at the conclusion of each meeting to summarize the content of the dialogue and to verify meaning (Guba & Lincoln, 1989).

Process Evaluation Procedures and Data Analysis

The SPACE process evaluation outcome variables and data analyses are described in Table 1.

Attendance. The number of educators who attended the physical activity workshop was documented by center. A percentage score was then calculated for the sample.

Table 1. Process Evaluation Outcome Variables of the SPACE Intervention.

Evaluation variable	Question	Data source	Tool or procedure	Data analysis
Workshop attendance	How many educators were present at the workshop?	Research team	Attendance recorded	% of potential attendees
Adherence to outdoor schedule	To what extent was the outdoor schedule implemented as intended?	Educator	Outdoor play log	% of classrooms offering 4 outdoor sessions <i>daily</i> for 8 weeks; % of days 4 outdoor sessions offered
Dose delivered	How many outdoor play sessions were delivered? Of these, how many met the 30-minute criteria?	Educator	Outdoor play log	% of total individual outdoor sessions offered for 8 weeks; % lasting 30 minutes
Context	What were the barriers and facilitators to implementation?	Educator	Program evaluation questionnaire; interviews	Descriptive statistics; themes identified through inductive content analysis
Feasibility	To what extent was the intervention easy and convenient to implement?	Educator	Program evaluation questionnaire; interviews	Descriptive statistics; themes identified through inductive content analysis
Perceived effectiveness and enjoyment	To what extent was the intervention: (a) effective at increasing children's physical activity and (b) enjoyable for both children and educators?	Educator	Program evaluation questionnaire; interviews	Descriptive statistics; themes identified through inductive content analysis
Communication	How effective was the communication?	Educator	Program evaluation questionnaire	Descriptive statistics
Future implementation	What is the likelihood of future implementation? Are there suggestions for improvement?	Educator	Program evaluation questionnaire; interviews	Descriptive statistics; themes identified through inductive content analysis

Note. SPACE = *Supporting Physical Activity in the Childcare Environment* intervention. Adapted from Saunders et al. (2005).

Adherence. Adherence to the modified outdoor schedule was evaluated using the outdoor logs completed by the educators. The number of days that all four outdoor periods were offered, as intended, was summed across the 8 weeks for a total score out of 39 days. A percentage score was calculated for each classroom and then averaged across the sample.

Dose Delivered. Dose was also evaluated using the outdoor logs completed by the educators. The total number of individual outdoor periods offered was summed across the 8 weeks for a total score out of 156 sessions. A percentage score for each classroom, and an average score for the experimental condition, were calculated. Outdoor sessions that were recorded as 30 minutes in duration were summed across the 8 weeks for each classroom, along with a percentage score that was calculated based on total outdoor sessions offered. An average percentage score for outdoor periods that met the 30-minute intervention criteria was also calculated.

Context and Feasibility. The barriers and facilitators to implementation (i.e., context) and feasibility were indicated by educators' scores on items specifically designed to explore these constructs, in addition to their responses to open-ended questions from the program evaluation questionnaire and

interviews. For each item on the program evaluation questionnaire, descriptive statistics were calculated using SPSS 24, while QSR International NVivo (version 11, 2015) was used to inductively code the qualitative data. Calculations were also performed to identify outdoor periods missed due to weather as indicated on the outdoor logs.

Perceived Effectiveness and Enjoyment. Educator perceptions of intervention effectiveness, their enjoyment of the intervention, and the children's enjoyment of the intervention were captured via items on the program evaluation questionnaire and interview questions. SPSS 24 was used to compute descriptive statistics, while the qualitative data was inductively coded using QSR International NVivo (version 11, 2015).

Communication and Future Implementation. Items on the program evaluation questionnaire assessed the effectiveness of communication between the research team and childcare personnel (i.e., directors, educators) and educators' anticipated future implementation of each component of the intervention. These items were analyzed using SPSS 24. Suggestions for improvement were revealed in response to interview questions, which were then coded into themes using QSR International NVivo (version 11, 2015).

Table 2. Demographic Characteristics of Educators in the SPACE Experimental Condition ($N = 49$).

Characteristics	<i>n</i>
Age, years, <i>M</i> (<i>SD</i>)	36.28 (9.45)
Sex (male, female)	2, 44
Ethnicity	
Caucasian	39
African Canadian	2
Arab	1
Latin-American	1
Asian	3
Years of work experience in childcare setting	
<5	6
5-9	9
10-14	4
20+	9
Employment status	
Full-time	39
Part-time	3
Highest level of education	
College	19
University	9

Note. SPACE = Supporting Physical Activity in the Childcare Environment intervention. Frequencies (*n*) unless otherwise noted. Frequencies may not add up to 49 as some participants did not answer all questions.

Results

Educators ($N = 49$; $M_{\text{age}} = 36.28$, $SD = 9.45$; 96% female) from 11 childcare centers (median preschoolers/center = 15; range = 7-32; median classrooms/center = 1; range = 1-6) delivered the SPACE intervention to a total of 200 preschool-age children ($M_{\text{age}} = 40.61$ months, $SD = 7.31$) in 18 classrooms. Educators' demographic information is presented in Table 2. Forty-one educators completed the program evaluation questionnaire, for a response rate of 84% (representing all experimental centers). The program evaluation questionnaire results are presented in Table 3. Seven educators (a response rate of 14%; representing six childcare centers) participated in an interview.

Attendance, Adherence, and Dose Delivered

Attendance at the workshop, adherence to the outdoor schedule, and dose delivered are presented by classroom in Table 4. Forty-seven of 49 (96%) educators and 11 center directors attended the single physical activity training session. The outdoor logs were collected from all 18 classrooms and educators recorded information for 99% of the outdoor periods. The prescribed schedule of four outdoor periods was offered each day in 88% of classrooms, and average adherence to the modified outdoor schedule was 71%. Educators who offered all four outdoor playtime sessions daily did so for a mean of 27.83 ($SD = 8.30$) of 39 days. When requisite individual

outdoor sessions were summed (i.e., dose delivered) across the sample, educators delivered an average of 90% of outdoor sessions during the intervention (~141 of 156). Of the outdoor sessions offered, an average of 87% were reported to have achieved the 30-minute standard. The remainder were recorded as 40 to 90 minutes in duration. Five classrooms did not report the length of their outdoor playtimes.

Context and Feasibility

Questions, themes, and example quotes from responses to open-ended questions regarding context and feasibility are displayed in Table 5. Educators reported challenges regarding the modified outdoor schedule. The increase in transitions was highlighted as the biggest obstacle and they cited that other daily programming (i.e., intellectual, social, emotional, and fine motor activities) suffered as a result. Educators noted that challenges were compounded by scheduling difficulties, preservation of compulsory educator-to-child ratios, and poor weather. Classrooms missed 5% ($M = 8.33$; $SD = 7.71$) of outdoor periods due to inclement weather (i.e., rain, thunder/lightning, or heat advisory) during the intervention period (Table 4). The solutions that educators listed to overcome barriers were maintaining a positive attitude, limiting other programming, adjusting when outdoor playtimes were offered throughout the day (e.g., implementing three in the morning and one in the afternoon), teamwork, and incorporating indoor physical activity during inclement weather.

Perceived Effectiveness and Enjoyment

Educator ratings of intervention effectiveness, preschooler enjoyment, and their own enjoyment with each intervention component from the program evaluation survey are presented in Table 3. Interviewee perceptions of effectiveness and expressed enjoyment of the intervention are reported in Table 6.

Communication and Future Implementation

Educator ratings of communication effectiveness between researchers and the childcare center, and among childcare personnel are displayed in Table 3 alongside scores that depict the likelihood of continued implementation of each intervention component. Example quotes illustrating educator suggestions for intervention improvement are presented in Table 6.

Discussion

The purpose of the study was to conduct a process evaluation of the SPACE intervention to assess its implementation through attendance, adherence, dose delivered, context, feasibility, perceived effectiveness, enjoyment, communication,

Table 3. Descriptive Statistics for the SPACE Program Evaluation Questionnaire.

Construct	Item	Mean	SD
Feasibility ^a	The intervention was easy to implement.	3.20	1.04
	When first approached to participate, I was very receptive to implement this intervention.	3.75	1.08
	The staff physical activity training was valuable.	4.27	0.92
	It was easy to have the guest physical activity instructor visit.	4.32	1.03
	The four, 30-minute outdoor play periods were easy to implement.	2.70	1.15
Perceived effectiveness ^b	The new physical activity equipment was easy to use.	4.39	0.92
	The staff physical activity training was effective.	4.13	0.76
	The guest physical activity instructor was effective.	4.02	1.11
	The four, 30-minute outdoor play periods were effective.	3.60	0.94
Educator's enjoyment ^c	The new physical activity equipment was effective.	4.34	0.68
	The staff physical activity training was enjoyable for me.	4.33	0.71
	The guest physical activity instructor was enjoyable for me.	4.02	1.00
	The four, 30-minute outdoor play periods were enjoyable for me.	3.04	1.15
Children's enjoyment ^c	The new physical activity equipment was enjoyable for me.	4.36	0.71
	The guest physical activity instructor was enjoyable for the children.	4.05	1.08
	The four, 30-minute outdoor play periods were enjoyable for the children.	3.18	1.19
Communication ^b	The new physical activity equipment was enjoyable for the children.	4.44	0.73
	Communication between the research team and your center?	4.02	0.94
	Communication between your director and the staff?	4.02	0.94
Future implementation ^d	Likelihood of using the knowledge from the staff physical activity training in the future.	4.38	0.75
	Likelihood of having a guest physical activity instructor visit in the future.	3.37	1.16
	Likelihood of continuing to implement the four, 30-minute outdoor play periods.	2.38	1.54
	Likelihood of continuing to use the physical activity equipment provided.	4.78	0.52

Note. SPACE = Supporting Physical Activity in the Childcare Environment intervention. Mean scored from 1 to 5; SD = standard deviation. Respondents were asked to rate the above statements from: ^a1 (strongly disagree) to 5 (strongly agree); ^b1 (not at all effective) to 5 (extremely effective); ^c1 (not at all enjoyable) to 5 (extremely enjoyable); ^d1 (not at all likely) to 5 (extremely likely).

Table 4. Attendance, Adherence, Dose Delivered, and Reason for Missed Outdoor Session by Centre and Classroom.

Centre (class) ^a	Attendance	Adherence	Dose delivered		Reason missed			
	Educator (director)	Days with 4 outdoor sessions ^b (%)	Outdoor sessions offered ^c (%)	Outdoor sessions of 30-minute duration ^d (% of offered)	Weather	Field trip	Ratios	Other
1	3 (1)	20 (51.28)	132 (84.62)	72 (54.54)	17	1	1	5
2	5 (1)	14 (35.90)	125 (80.13)	—	13	—	8	10
3	2 (1)	32 (82.05)	148 (94.87)	140 (94.59)	4	—	—	4
4(a)	3 (2)	33 (84.62)	149 (95.51)	145 (97.32)	4	—	—	3
4(b)	2	37 (94.87)	151 (96.79)	151 (100)	4	—	1	—
4(c)	2	27 (69.23)	142 (91.03)	142 (100)	2	—	12	—
4(d)	2	35 (89.74)	152 (97.44)	152 (100)	—	—	4	—
4(e)	2	38 (97.44)	154 (98.72)	—	2	—	—	—
4(f)	2	33 (84.62)	138 (88.46)	136 (98.55)	1	—	17	—
5	2	10 (25.64)	125 (80.13)	96 (76.80)	2	—	—	29
6	5	36 (92.31)	151 (96.79)	—	3	—	—	2
7	2 (1)	31 (79.49)	146 (93.59)	—	9	—	—	3
8	4 (1)	37 (94.87)	154 (98.72)	154 (100)	2	—	—	—
9	3 (1)	29 (74.36)	142 (91.03)	—	13	—	—	1
10(a)	2 (1)	22 (56.41)	131 (83.97)	89 (67.94)	12	3	—	11
10(b)	2	23 (58.97)	131 (83.97)	105 (80.15)	15	2	—	9
11(a)	2 (2)	23 (58.97)	134 (85.90)	111 (82.84)	22	—	—	2
11(b)	2	21 (53.85)	129 (82.69)	109 (84.50)	22	—	—	3

^aBrackets identify individual classrooms within centers. ^bTotal number of days possible = 39. ^cTotal number of outdoor sessions possible = 156. ^dFive classrooms did not provide outdoor duration.

Table 5. Example Quotes Describing Context Themes and Feasibility.

Question	Theme	Example quotes	
		Program evaluation survey	Interview
Challenges	Transitions	The children had a hard time dealing with all of the extra transitions.	Just the frequent transitioning. It doesn't really mesh with our curriculum.
	Other programming	Did not create enough room to implement and engage in other daily activities at the children's pace and time.	We found that our programming was falling behind a little bit.
	Scheduling	When we had three groups trying to get out six different times a day.	. . . the schedule is a little tighter than you might think it is.
	Ratios	The final 30-minute outdoor play period was sometimes difficult to incorporate due to staff schedules and ratios.	It was hard in the afternoons with staff going home.
	Weather	Weather too hot/raining.	We did, a few days, have to dress [for cold weather] and it was difficult.
Solutions	Attitude	Having a good attitude about the study to the children.	We were really open . . . this is how it is, and . . . we agreed to do this . . . let's rock it out.
	Limit other programming	In order to have the full half hour, we had to shorten the time of indoor activities.	That's really the other thing we had to give up [the programming].
	Flexibility	3 x 30 min in am and one in pm.	We changed our routine quite a few times to see what would work best for us.
	Teamwork	Brainstorming ideas with staff members and teamwork with co-workers.	. . . just kind of juggle ideas of how they can be creative. . .
	Indoor physical activity	We have access to a gym (occasionally) during bad weather.	We'd bring things in the hallways, or into the classroom.
Feasibility	Modified outdoor schedule	I think it's more feasible with a smaller group.	It's easy in the morning, but it was the afternoon that was more difficult because we had separate groups, the awake kids, the [a]sleep kids.

Table 6. Interview Participants' Perspectives on Intervention Effectiveness, Enjoyment, and Suggestions for Improvement.

Evaluation component	Theme	Example quote
Perceived effectiveness	Intervention	So that was good because we were more active, they were more active.
Enjoyment	Educator	The staff training was really good because it kind of broke our fears toward physical activity. I can do it, so the children can do it.
	Preschooler	I think the children did really well with it. I think the children enjoyed it. It was good, yeah.
Suggestions for improvement	Number of outdoor periods	I think three periods of outdoor play would work better. Two in the am and one in the pm.

and future implementation. The results demonstrate high rates of attendance at the physical activity workshop (~96%); compared with other childcare physical activity interventions, this rate is particularly high. For example, only 41% of participating teachers attended training in a multilevel intervention conducted in Australia (Finch et al., 2014). However, childcare educators have previously acknowledged their

interest in additional training and readiness to attend physical activity workshops (Tucker, van Zandvoort, Burke, & Irwin, 2011). Thus, the high rate of attendance reflects educator compliance with the intervention protocol and may be a result of their enthusiasm for additional training. The importance of buy-in from those who deliver the intervention has been highlighted as influential in successfully implementing programs

(Durlak & DuPre, 2008). That both directors and educators chose to attend workshops held outside of work hours for which they were not compensated for, demonstrates the commitment of participants to the SPACE study.

The intervention was implemented as intended and adherence rates to the modified outdoor schedule were high. Notably, educators delivered (and preschoolers received) 90% of the total number of compulsory individual outdoor sessions. In a review of the literature that examined associations between implementation and outcomes, few of the studies reviewed achieved more than an 80% implementation level, and implementation of 60% or more resulted in successful outcomes (Durlak & DuPre, 2008). The Study of Health and Activity in Preschool Environments (SHAPES) intervention by Pate et al. (2016) was similar to the SPACE intervention in that it also delivered a combination of teacher training and outdoor physical activity opportunities that proved effective at improving the MVPA levels of childcare enrolled preschoolers. Interestingly, when the implementation of the SHAPES intervention was evaluated, results showed no association between centers that adhered more fully to the program and physical activity, with one exception (Saunders et al., 2017). High implementation of the outdoor recess component (i.e., providing opportunities to be active outdoors) was associated with greater MVPA in girls compared with low-implementation and control groups (Saunders et al., 2017). The SPACE intervention was found to improve the MVPA and TPA levels of preschoolers while the intervention was operating (Tucker et al., 2017). The high levels of implementation, particularly with regard to the modified outdoor schedule, may have driven these positive results. This supplies further evidence that more frequent outdoor time contributes to improved physical activity in childcare.

The educators reported that the majority (87%) of the daily outdoor sessions that they provided met the requisite 30 minutes specified by the SPACE intervention. However, it was not uncommon for educators to implement the fourth and final outdoor playtime for more than 30 minutes, lasting anywhere between 40 to 90 minutes. This extended outdoor period was typically employed to maintain the mandatory educator-to-child ratios as staff finished their shifts and left for the day. That they were able to modify their schedule for 8 weeks to include four daily outdoor periods (vs. the provincially mandated 2×60 -minute outdoor periods) with at least three, and often four, *shorter* bouts of outdoor time, provides support for the potential viability of this outdoor schedule for long-term use in childcare. In some countries, the provision of 30-minute outdoor free play periods is the norm (e.g., Alhassan, Nwaokemeh, Lyden, Goldsby, & Mendoza, 2013; Cardon, Van Cauwenberghe, Labarque, Haerens, & De Bourdeaudhuij, 2008). Nonetheless, educators expressed that implementing the multiple outdoor playtimes was challenging, not due to the reduced length of individual outdoor periods, but because of the increased number of indoor/outdoor transitions. Those who have previously pilot-tested an

increased number of outdoor periods (i.e., 4×30 minutes) in the preschool setting, advised against adding any more than this amount of outdoor time due to the school's existing academic curriculum (Alhassan, Sirard, & Robinson, 2007). The educators in the SPACE study also noted a decline in aspects of their other programming during intervention delivery, stressing that it was the more frequent transitioning, and lack of time for preschoolers to engage in indoor academic activities, that made this component challenging.

The SPACE intervention was well-received by educators and viewed as appropriate for implementation in childcare centers. Not only did they rate the training component as enjoyable, but they also found it to be valuable. Likewise, educators expressed that the children enjoyed the new equipment and found it easy to use. Educators identified that they would continue to use the knowledge gained and the equipment provided following the intervention period. However, educators noted that they did not intend to continue implementing the modified outdoor schedule once the SPACE intervention ceased, and they suggested that three, rather than four, outdoor periods may have been more feasible. In childcare, the impact of three shorter (i.e., a minimum of 15 minutes) periods of outdoor free play on children's physical activity has recently been examined (Wolfenden et al., 2016) and was found to improve children's MVPA during childcare hours (Razak et al., 2018). The rationale provided by Wolfenden et al. (2016) for this outdoor schedule is supported by evidence that suggests that children are most active in their first 15 minutes outdoors (Greever, Sirard, & Alhassan, 2015), and that their activity levels peak during repeated opportunities for outdoor free play in childcare (Pate, Dowda, Brown, Mitchell, & Addy, 2013; Wolfenden et al., 2016). The high rates of adherence to the outdoor component of the SPACE intervention identified in this study combined with preschooler physical activity improvements illustrate the potential value in modifying childcare outdoor schedules to include shorter, more frequent outdoor free playtimes. Given that the effects of the SPACE intervention, including increased MVPA and TPA, and reductions in sedentary time, were not sustained at 6- and 12-month follow-up, it is hypothesized that the improvements in preschoolers' physical activity levels were primarily influenced by the shorter, more frequent outdoor playtimes (Tucker et al., 2017). Thus, it is important to examine the isolated effects of a modified outdoor schedule on preschoolers' physical activity levels in the future, and to identify the ideal frequency and duration of outdoor sessions that are most appropriate for supporting preschoolers' engagement in higher levels of MVPA and TPA in the childcare setting (Pate et al., 2013).

Strengths and Limitations

The SPACE intervention, a cluster randomized controlled trial composed of three components informed by successful characteristics of previous preschooler interventions

(Gordon et al., 2013), was implemented in childcare classrooms for 8 weeks, was delivered by educators rather than members of the research team, and afforded the flexibility to adapt the modified outdoor time to fit each center's unique daily programming and schedule. Despite these strengths, the limitations of this study must be acknowledged. First, the high rate of adherence to outdoor playtimes was based on the educators' self-reports and, therefore, may have been influenced by social desirability bias. Additionally, while educators from 13 classrooms reported the duration of time that they spent outdoors for each outdoor period, it is unclear whether educators from five classrooms adhered to the obligatory length of outdoor sessions (i.e., 30 minutes) as these educators reported the *time* that the outdoor period was initiated, rather than the *length* of time spent outside. Thus, it is possible that adherence rates may be slightly inflated. Second, despite the high visibility of the supplied portable play equipment during site visits performed by the project coordinator, the rate of rotation and children's accessibility to the equipment was not formally evaluated, and this may have influenced the effectiveness of the intervention. Finally, although the sample consisted of randomly selected childcare centers, all were located within London, Ontario, Canada, thereby reducing the generalizability of the findings.

Implications for Policy and Practice

Successful outcomes of the SPACE intervention (Tucker et al., 2017), combined with results from this evaluation, provide support for considering the design and implementation of outdoor playtime within childcare legislation and/or policies of individual childcare organizations. Currently, Canadian legislation does not stipulate time for physical activity during childcare hours (Vanderloo et al., 2012); rather, it is compulsory that children receive time for gross motor movement and outdoor exposure, but *how* children spend their time is not identified (e.g., sedentary in the sandbox vs. running around). The results of the SPACE intervention provide evidence that the combination of physical activity training, portable play equipment, and shorter more frequent outdoor periods is viable in center-based childcare, and is an effective method for supporting physical activity among preschoolers (Tucker et al., 2017).

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