Intervention fidelity in a teacher-led program to promote physical activity in preschool-age children

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A B S T R A C T

Objective. To examine protocol fidelity among teachers involved in a six-month cluster-randomized physical activity (PA) intervention.

Methods. In 2011, preschools in Springfield, MA were randomized to short bouts of structured PA (SBS-PA, n = 5) or unstructured playtime (UPA, n = 5). SBS-PA provided structured PA in the classroom during the first 10 min of gross-motor playtime followed by 20 min of unstructured playtime. UPA consisted of 30 min of unstructured playtime. All teachers (SBS-PA and UPA) received a written study protocol and 1.5 h of training. SBS-PA also received videos to use to lead structured PA and 1.5 additional hours of training. Study fidelity and process evaluation were assessed twice weekly via semi-structured questionnaire.

Results. Only 56.6% of SBS-PA and 75.2% of UPA free playtimes lasted for 30 min; 86.3% of SBS-PA teachers implemented structured PA during the first 10 min of gross-motor playtime but only 67.2% delivered the intervention as instructed. Only 68.5% of SBS-PA teachers implemented the 20-minute unstructured playtime. SBS-PA teachers reported that time limitations was a major barrier in implementing the designed intervention. Pre-post changes in PA did not differ between groups.

Conclusion. Limited fidelity to intervention protocol likely impacted study findings. Future studies should focus on strategies to improve adherence among intervention leaders.

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Introduction

Most preschoolers in the US spend a significant part of their day at preschool centers (Federal Interagency Forum on Child and Family Statistics, 2011). Preschools provide a great setting to intervene on preschoolers’ physical activity (PA) levels (Ward et al., 2010). Several interventions have targeted preschoolers’ PA levels, but most have had limited impact on altering PA levels (Campbell and Hesketh, 2007; Mehtala et al., 2013; Wenz-Gross and Upshur, 2012). Variability in PA intervention effectiveness could be related to study fidelity and implementation issues (Durlak and DuPre, 2008; Masse et al., 2013; Wenz-Gross and Upshur, 2012). Fidelity refers to adherent and competent delivery of an intervention protocol by those assigned to deliver it, and is an important aspect of understanding feasibility, acceptability, and findings of intervention studies (Durlak and DuPre, 2008). Research in elementary school settings has shown that factors such as teacher training, teacher turnover rate, intervention buy-in, and preschool characteristics can impact the implementation of PA interventions (Eisenmann et al., 2008; Hall et al., 2012; Masse et al., 2013; Wenz-Gross and Upshur, 2012). However, at the preschool level there has been very limited research on study fidelity and implementation.

The Short bouts of Exercise for Preschoolers (STEP) study was a six-month cluster-randomized study that tested a strategy for increasing preschool day PA among low-income preschoolers. Because of the age of the target audience (2.9–5 years) the intervention was led by teachers/staff. This report describes fidelity to the intervention protocol among teachers participating in the STEP study.

Methods

The STEP study rationale and design, methods and participant characteristics have been previously described in detail elsewhere (Alhassan et al., 2012). Briefly, 10 preschool centers in the greater Springfield, MA area were randomized to implement a 10-minute bout of structured PA followed by 20 min of unstructured playtime (SBS-PA, n = 5) or 30 min of unstructured playtime (UPA, n = 5). The study was approved by the University of Massachusetts Amherst Institutional Review Board and preschoolers’ parents and classroom teachers provided written informed consent.

The Tutti Frutti Instant Recess® (TFIR) intervention was adapted for preschoolers from the Instant Recess® (IR) program (Whitt-Glover et al., 2011; Yancey et al., 2004). TFIR, available on DVD, was a 10-minute moderate-intensity PA routine set to music and designed to be led by...
teachers (who are watching the video); preschool students watched and mimicked teacher movements. Teachers in schools assigned to SBS-PA were trained to implement TFIR during the first 10 min of student’s usual 30-minute gross-motor playtime. For the remaining 20 min students engaged in unstructured play. Sixteen TFIR DVDs were rotated weekly throughout the 6-month study. Teachers in schools assigned to UPA implemented the traditional 30-minute bout of unstructured gross-motor playtime. The UPA intervention served as the control group for this study. Both SBS-PA and UPA interventions were implemented during morning and afternoon gross-motor playtimes, five days/week for six months.

**Teacher training/process evaluation**

Research staff facilitated teacher trainings at the beginning of the study, and refresher-training sessions were provided during the study to ensure standardization of both intervention protocols. The training sessions were held separately for staff at each preschool center. Training for SBS-PA teachers (3 h), included information on the importance of PA and how to implement the TFIR protocol. During the three-hour training session, teachers were taught how to lead preschoolers in TFIR activities and were guided through three different TFIR routines. Training (1.5 h) of the UPA teachers focused on the importance of allowing their students to play freely during gross-motor playtime. Research staff members were available throughout the 6-month protocol to assist classroom teachers in implementing their assigned intervention.

Study fidelity was assessed at least twice per week at each center during the 6-month protocol by research staff. Research staff used a standardized semi-structured questionnaire to assess the following: intervention implemented as designed, duration of the gross-motor playtime (dosage of the intervention), location of gross-motor playtime, percentage of children in the classroom participating in intervention, perceived children enjoyment level, and time allowed for structured and unstructured free playtime. Teachers’ perceptions of the intervention were assessed at the completion of the study using an open-ended questionnaire. Means and standard deviations were calculated for quantitative variables. For qualitative variables, examples of quotes were presented.

**Results**

Data collected during fidelity checks suggested adherence to the study protocol among intervention leaders (teachers) was low (Table 1). Although a significant number of SBS-PA teachers (86.5%) implemented the TFIR DVDs during the first 10 min of playtime, only (67.2%) of classroom teachers led the PA as instructed; other teachers allowed the students to watch the video and lead themselves. While SBS-PA teachers were instructed to follow the 10 min of structured PA with 20 min of unstructured play, only 68.5% of the SBS-PA teachers implemented the unstructured playtime portion of the intervention. When unstructured playtime was implemented it typically lasted for <20 min. In both groups, total PA offered at each playtime fell short of the desired goal; only 56.6% of SBS-PA and 75.2% of UPA gross-motor playtime lasted for 30 min. These data indicate that, overall, children in UPA (control) schools, on average, were offered more daily playtime than children in SBS-PA (intervention) schools. In both groups, a greater percentage of the morning gross-motor playtime intervention (SBS-PA, 68%; UPA, 69.7%) was implemented compared to the afternoon gross-motor playtime intervention (SBS-PA, 18.5%; UPA, 19.6%). Relative to preschool day PA, percent of time spent in MVPA (assessed with accelerometers) significantly decreased in both groups at 3-months and at 6-months. No other significant changes were observed.

Open-ended questionnaires indicated barriers to implementation. Barriers to SBS-PA intervention implementation are listed in Table 2. Reasons for shortened playtime included lack of time, particularly given the time it took teachers to transition between structured and unstructured PA. The average transition time was 4.9 ± 4.7 min. However, there was significant difference in the transition time when the 20-minute gross-motor playtime was indoors (average = 2.5 ± 2.9; minimum = 0 min; maximum = 10 min) or outside (average = 8.2 ± 4.7; minimum = 3 min; maximum = 20 min). SBS-PA teachers reported limiting unstructured playtime because they believed the TFIR DVD provided adequate amount of PA for the children. Teachers also suggested completing required paperwork for the study was inconvenient. SBS-PA teachers also reported implementing the structured PA portion of the intervention, at the times that were not indicated in the study protocol. For example, one teacher stated "the DVDs were really handy when I needed to set up for lunch and need to keep them busy with doing something else". Another teacher said "the DVD was really useful when they were acting out, and I need them to settle down. I noticed that they were a bit calmer when they did the DVD or right when we came back from outside."

**Discussion**

Researchers have long believed that accurate interpretation of study outcomes depends on not only knowing if the entire intervention was delivered but also what aspects were better delivered and how well they were conducted (Durlak and DuPre, 2008). In the current study, teachers were trained to lead an intervention designed to increase PA among preschool children. Assessments of study fidelity indicated lower adherence to the study protocol among teachers in intervention compared to control schools, particularly with regard to total PA time offered to preschoolers.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Intervention fidelity (assessed via observation).</th>
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<tbody>
<tr>
<td>Fidelity question (% responding “yes” for each question)</td>
<td>SBS-PA (%)</td>
</tr>
<tr>
<td>Did intervention last for at least 30 min?</td>
<td>56.6</td>
</tr>
<tr>
<td>Did MVPA occur at least 50% of intervention time?</td>
<td>65.7</td>
</tr>
<tr>
<td>During gross-motor time, did classroom teachers allow children to play freely on their own?</td>
<td>55.4</td>
</tr>
<tr>
<td>Was gross-motor time outside?</td>
<td>28.3</td>
</tr>
<tr>
<td>Were children allowed to participate in gross-motor time during intervention time?</td>
<td>n/a</td>
</tr>
<tr>
<td>Was TFIR DVD implemented during the 1st 10 min of intervention?</td>
<td>86.5</td>
</tr>
<tr>
<td>Was the TFIR DVD implemented in the expected 10-minute duration?</td>
<td>80.3</td>
</tr>
<tr>
<td>Did at least 50% of classroom children participate during the TFIR DVD?</td>
<td>75.3</td>
</tr>
<tr>
<td>Did the majority of the children participate in at least 5 min of the TFIR DVD?</td>
<td>75.7</td>
</tr>
<tr>
<td>Did classroom teacher provide encouragement during the TFIR DVD?</td>
<td>80.8</td>
</tr>
<tr>
<td>Did classroom teacher implement the TFIR DVD as intended (i.e., teacher leading TFIR DVD and students following teacher)?</td>
<td>67.2</td>
</tr>
<tr>
<td>Did 20 min of gross-motor time follow the TFIR?</td>
<td>68.5</td>
</tr>
<tr>
<td>Did gross-motor time last for at least 20 min?</td>
<td>52.0</td>
</tr>
</tbody>
</table>

SBS-PA = short bouts of structured physical activity; UPA = unstructured physical activity; TFIR = Tutti Frutti Instant Recess. Study data was collected between Fall 2011 through Spring 2012 in Springfield, MA.

<table>
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<tr>
<th>Table 2</th>
<th>Qualitative data on barriers to study protocol implementation reported by SBS-PA teachers.</th>
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</thead>
<tbody>
<tr>
<td>Barrier</td>
<td>Exemplar quote</td>
</tr>
<tr>
<td>Time</td>
<td>“in order to do the DVD I have to rearrange my classroom, which takes time and then after the DVD; I have to get the children into circle time before they can get dressed to go outside. So although the program is only 30 minutes, it actually took me anywhere from 45 to 60 minutes.”</td>
</tr>
<tr>
<td>Excessive paperwork</td>
<td>“by the time we get the kids inside I have other things to do and forgot to write things down, I mean I did the program so what is the big deal about writing it down.”</td>
</tr>
<tr>
<td>Preschool schedule</td>
<td>“I could never do the afternoon DVD because I had to get the kids ready to go home. A lot of my kids leave on the bus which leaves after their afternoon snack.”</td>
</tr>
</tbody>
</table>

SBS-PA = short bouts of structured physical activity. Study data was collected from Fall 2011 through Spring 2012 in Springfield, MA.
One potential barrier to implementing classroom PA was the time required for implementation. A recent review of the benefits of classroom PA breaks suggested time and space as constraints for implementing classroom-based PA (Whitt-Glover et al., 2013). A significant number of teachers in the SBS-PA classrooms indicated that implementing TFIR DVDs, the 20-minute free playtime, and completing the intervention logs required too much time. IR breaks are designed to require minimal transition time because they are incorporated into ongoing activities within an organization (e.g., meetings, classroom) and designed to break up long bouts of sitting. In most cases, IR participants’ transition back to a sedentary activity immediately following the break (e.g., sitting down and continue meeting), which reduces transition time. In addition, TFIR and other IR breaks are designed to require minimal space requirements (e.g., can be performed standing next to a desk in a classroom or in front of a chair in a conference setting). It appears that teachers in the current study may have perceived that a separate set up was needed to perform the TFIR routines as evidenced by comments about needing to rearrange the classroom to prepare for activity. Teachers also indicated an additional time burden required to prepare children for outdoor play. Although it is assumed that preparation for outdoor play was not impacted by the study since teachers would have had to prepare children for outdoor play anyway, the perceived additional time requirement could have impacted teacher willingness to comply with the study protocol. Based on the statements from classroom teachers, it seems that the SBS-PA intervention was not easily integrated into everyday practices of the preschool centers and, therefore, created undue burden for the teachers. Researchers have noted that the degree to which a program’s objects and procedures can be interwoven into daily practice of school the more likely it is that the intervention will be implemented as designed (Derzon et al., 2005). Rearranging the classroom or getting the children ready to go outside was not factored into the time required for implementation during study planning.

Additional uncontrollable factors also impacted implementation and could have attributed to the observed difference in the intervention dosage between the SBS-PA and UPA groups. For example, teachers were supposed to implement the intervention for 30 min in the morning and 30 min in the afternoon. However, a large portion of the afternoon sessions in the SBS-PA did not take place. Three out of the five SBS-PA preschool centers (compared to only 1 UPA preschool center) had a large portion of their students bussed to and from the preschool center. SBS-PA teachers had very limited time after naptime to prepare students for buses and, therefore, were less likely to implement the afternoon intervention.

A significant portion of the SBS-PA classroom teachers indicated that they used the TFIR DVD at times other than prior to unstructured playtime. Based on the comments from the classroom teachers it is possible that this type of intervention may work better if teachers were provided with flexibility to use TRIF at their discretion. Overall, the TFIR portion of the intervention was well received by the classroom teachers based on the percentage of teachers who offered it. Given the number of teachers who indicated they did not always record when TFIR was offered, implementation might have been underestimated. When TFIR was offered, a high percentage of preschoolers participated in the structured PA suggesting that TFIR is feasible and acceptable for providing PA to preschoolers during the school day.

There are a few limitations to the current study, including uncontrollable factors that impacted program implementation and fidelity and small sample size (number of preschool centers included). Study strengths include the randomized, controlled design, standardized training curriculum and collection of program implementation, and objective physical activity assessment.

Conclusion

Previous research has highlighted the utility of activity breaks to increase PA during the school day among school-age children. Few studies have examined activity breaks in preschools. This study highlights factors that could impact the delivery of an activity break intervention in a preschool setting and highlights factors to consider when implementing a similar program. It is important for intervention studies to assess and analyze intervention fidelity when considering program outcomes.

List of abbreviations

- PA: physical activity
- MVPA: moderate-to-vigorous physical activity
- SBS-PA: short bouts of structured physical activity
- STEP: Short bouts of Exercise for Preschoolers
- UPA: unstructured physical activity
- TFIR: Tutti Fruitti Instant Recess®
- IR: Instant Recess®

Conflict of interest statement

Melicia C. Whitt-Glover has received federal and foundation funding to develop and evaluate IR materials. All other authors have no conflict of interest.

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References