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A Thesis Presented

By

LUKE M. SUDARSKY

Submitted to the Graduate School of the University of Massachusetts Amherst in partial fulfillment of the requirements for the degree of

Master of Science

September 2022

University of Massachusetts Amherst Department of Kinesiology

A Thesis Presented

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ABSTRACT

FEASIBILITY, ACCEPTABILITY AND PROCESS EVALUATION OF A PHYSICAL ACTIVITY INTERVENTION IN TODDLER AGED CHILDREN: THE TAP-A-LONG STUDY

September 2022

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Recent literature has suggested the importance of physical activity in early childhood such as during the toddler years (12 months - 3 years). Despite this, most toddlers are not physically active. There is a need to determine the types of physical activity programs that would interest toddlers within the settings they spend a significant amount of time in (e.g., childcare center). Currently, data on the feasibility, implementation, and process evaluation of physical activity interventions in toddler age children attending childcare centers is lacking within the literature. Therefore, the purpose of the Toddler Activity Pilot (TAP-A-LONG) study was to examine the feasibility and acceptability of a four day per week, 10-week physical activity program in toddler aged children during the childcare day. Process evaluation data was collected daily during the entire 10-week study using a semi-structured questionnaire. Once per week on a randomly selected day, toddlers’ physical activity was assessed with accelerometers during the 10-minute intervention session or gross-motor playtime for the treatment and control group.
respectively. Accelerometers were also worn for the duration of the full day during baseline, midpoint, and post. Participants were male (58%), white (46%), and lived in a household with married parents (58%). Toddlers’ average age was 25.0 ± 4.2 months. A total of 69.4% of the toddler population was recruited to participate in the study amongst the three participating centers (TAP = 37; CON = 13). During the 10-minute intervention session, toddlers in the treatment group spent 60.4 ± 22.0%, 28.7 ± 15.7%, and 10.9 ± 10.6% of time in sedentary (SED), light physical activity (LPA), and moderate-to-vigorous physical activity (MVPA), respectively. While control center spent 55.7 ± 18.8%, 35.9 ± 15.1, and 8.4 ± 8.0% in SED, LPA, and MVPA, respectively. For program quality, 76.7% and 62.0% of researcher and provider led intervention sessions were delivered clearly (i.e., directions were understandable to toddlers), respectively. The majority of intervention sessions held toddlers’ attention (60% of toddlers participated in at least half of the intervention). Overall, the high acceptability of our TAP-A-LONG intervention highlights the usefulness of physical activity interventions within the childcare setting.
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CHAPTER I
INTRODUCTION

Background

The toddler age (12 months – 3 years) is an important period of growth and development during early childhood (1-3). During this period of early childhood, many habits such as gross motor skills (early foundation of complex movement pattern) and physical activity (PA) habits start to develop (4, 5). This is important because PA has been associated with a large range of beneficial health outcomes throughout childhood (6-8). For example, PA has been reported to promote stronger bones in children (9, 10), and lead to improvements in cognition (11). Notably in a recent systematic review, several studies have highlighted the need to increase PA during early childhood, as PA is crucial for development (1). Due to the beneficial impact of PA on overall health in children of all ages, several organizations have published PA recommendations for children.

A significant proportion of PA recommendations have focused on preschool-age children and older children (12-14). However, in the past few years, a handful of PA recommendations have been published that have also included toddlers. For example, in 2018 the Australian government released an updated PA guideline for children ages 0-5 years old, which stated that toddlers should accumulate at least 180 minutes per day in a variety of PA including energetic play (15). The recommendations also stated that sedentary time should be limited to less than 60 minutes per day with the exclusion of sleep (15). Similarly, the Canadian PA guidelines for children aged 0-5 years old state
that young children should spend at least 180 minutes per day participating in activities of varying intensities, including energetic play and play that encourages development of movement skills (16). In addition, the guidelines recommend limiting sedentary activities (16). Unfortunately, despite these recommendations there is evidence that toddlers spend a significant portion of their day engaged in sedentary activity (17-19).

In order to help improve toddlers PA, it is important to look at one of the settings outside the home that toddlers spend a significant portion of their day – the childcare center. Currently, it is estimated that 46% of children aged 1-2 years old spend at least part of their day in some form of nonparental care such as center-based childcare programs (20). Childcare centers and the role of childcare providers offer a unique opportunity to intervene on the health behavior of young children due to their custodial role of nurturing young children’s physical, emotional, and health behaviors. Therefore, the childcare setting represents an opportune place to intervene on toddlers’ health behaviors such as their PA.

Within the childcare setting, research has shown that toddlers spend a significant portion of their day in sedentary pursuits such as sitting during circle time or free play (21). One systematic review of sedentary time in infants and toddlers found that toddlers spend 337 minutes per day in sedentary activities (22). In childcare settings toddlers could spend up to half of their day engaged in sedentary time (23). When toddlers do engage in PA, it is acquired mostly through light-intensity PA (24). When left on their own, rarely do toddlers engage in moderate-to-vigorous intensity activities (21). Therefore, within the childcare center, it is possible that childcare providers could play a
role in influencing toddlers to participate in activities that fall within the moderate to vigorous intensity category range.

For toddler aged children MVPA can be defined as activity resulting in more than 418 counts when measured via Actigraph accelerometers (25). One study examining providers perception about PA during the childcare day found that although providers understood the importance of PA, many did not believe that toddlers required more than 90 minutes per day of activity time (26). The environment in which children spend time has been shown to impact aspects of their PA (27, 28). For example, children exhibit different levels of PA in different environments (i.e., indoor vs outdoor) (27, 29, 30). Even between childcare centers, PA can differ based on providers perceptions of PA (31) or outdoor/indoor space availability (27). An environmental assessment study conducted by Peden et al., (32) found that childcare centers that provide more play equipment, or provided structured PA lessons had lower total sedentary times compared to centers that did not provide these PA opportunities. Due to this, it is possible that PA interventions could represent a possible solution to reduce the excessive sedentary time that toddlers are exposed to while at childcare centers. Currently only three PA study has been conducted in toddlers (31, 33, 34). However, these studies focused on other outcomes such as changing childcare center PA policy (31) or developing gross motor skills (34) and did not provide any specific instructions or guidance to providers on how to influence toddlers PA (31, 33, 34). Additionally, process evaluation data (systematic evaluation to determine program activities were implemented as designed) such as intervention fidelity and acceptability for these studies was not the priority of previously mentioned studies and in-depth process evaluation is currently lacking from the literature.
Several studies have reported high levels of sedentary time in toddlers during the childcare day (19, 21, 22), there is a clear need for feasible and acceptable PA interventions to help reduce toddler’s sedentary time while at childcare centers. In addition, there is a need to determine the process evaluation data associated with PA interventions. Therefore, the purpose of this study is to examine the feasibility and acceptability of a 10-week PA program implemented within the childcare center in toddlers.

Research Aims and Hypotheses

Aim 1: To examine the feasibility of a 10-week PA program in toddlers enrolled in childcare. For this study, feasibility will be defined as participant recruitment, retention, and toddlers’ ability to wear the accelerometer.

\[H_{1a}\]: Participant recruitment will exceed 70% of the total toddler population of the participating childcare centers.

\[H_{1b}\]: Retention will be 75% at 10-week data collection. Based on our labs prior experience in recruiting and retaining preschool-age children within childcare centers, we hypothesize that utilizing our lab’s recruiting and retention protocol - our recruitment and retention goals will be met.

\[H_{1c}\]: At each assessment timepoints, at least 75% of participants will wear the accelerometer for at least one assessment day (9am-5:00pm). This hypothesis is based on our lab’s experience in working within childcare centers.

Aim 2: To examine the implementation outcome of a 10-week PA program in toddlers enrolled in childcare. For this study, implementation outcome will be assessed as 1)
fidelity (number of original PA lesson implemented as designed); 2) PA intensity (time spent during the 10 minute intervention that is ≥ light intensity PA); 3) dosage (the number of lessons implemented, out of total lessons planned); 4) program quality (the number of lessons implemented clearly (i.e., directions were understandable to toddlers), out of the total lessons implemented), and 5) program adaption (any changes made to the lesson plans).

$H_{2a}$: For study fidelity, we hypothesize that at least 80% of the interventions will be implemented as designed.

$H_{2b}$: For PA intensity, we hypothesize participants will spend at least 50% of the intervention time engaged in light intensity or higher activity.

$H_{2c}$: For intervention dosage, we hypothesize that >80% of lesson plans will be implemented.

$H_{2d}$: For program quality, we hypothesize that >80% of lessons will be implemented clearly and correctly.

$H_{2e}$: We have no specific hypothesis for adaptations, this is because adaptations are not foreseen changes to the program.

**Aim 3:** To examine the acceptability (i.e., enjoyment and satisfaction) of a 10-week PA program in toddler childcare providers.

$H_{3a}$: We hypothesize that the childcare providers will have a high level of enjoyment and satisfaction with the PA intervention as rated by providers in the post intervention survey and as reported by trained data collectors.
CHAPTER II
REVIEW OF LITURATURE

Overview

Toddler age (12 months - 3 years) is a unique period of growth and development, during this window children rapidly develop physically, emotionally, and cognitively. Physical activity (PA) has been reported to benefit this period of development because of the cognitive demands required to complete goal oriented activities and complex motor control tasks associated with PA (35). Additionally, some research has suggested that PA is associated with better cognitive outcomes is young children (35). PA also provides an opportunity for young children to interact with peers and potentially improve behavior. A study by our lab has suggested that following a structured PA intervention in preschoolers, participants were better behaved in the classroom setting (36). Health related behaviors such as PA developed during this period of life have been reported to track into adolescence and then into adulthood (37). Currently, 46% of toddlers in the United States spend at least part of their day enrolled in center-based childcare arrangements (20). Toddlers in childcare centers spend a significant portion of their day engaged in sedentary pursuits (22, 38). On average, research shows that within the childcare day, toddlers spend approximately 74% of their time engaged in sedentary behaviors and limited time engaged in more intense activities (21). Currently, it is recommended that toddlers participate in at least 180 minutes of total PA (light to
vigorous intensity activities) per day (15, 16). Examples of light intensity activities in toddlers include activities such as walking, light arm movements, and crawling), while vigorous activity include activities such as running and hopping (25). Unfortunately, there is evidence to indicate that few toddlers enrolled in childcare meet the PA recommendations (39). Therefore, childcare centers could play an important role in increasing PA among the toddlers they serve. Presently, due to limited studies of PA in toddlers, PA intervention studies should be conducted to determine the best methods of intervening on toddler’s PA behaviors. Prior to examining the effectiveness of PA programs design to improve toddler’s activity level, it is important to first determine the feasibility and acceptability of these programs.

This literature review will be separated into four sections. The first section will review the importance of PA and its relationship to health indicators in toddlers. The first section will also cover PA recommendations in toddlers. Section two will examine toddler PA within the childcare setting. Section three will examine other childcare center-based PA programs that have been published. Section four will address process evaluation and the importance of using process evaluation for toddler-based PA studies within the childcare setting.

**Physical Activity and Health indicators in Toddlers**

Recent research in toddlers indicates that PA is positively associated with both healthy visceral and subcutaneous adipose tissue deposition (40). Although the exact impact of this is currently unknown, there is evidence to suggest that obesogenic health related indicators do begin to develop in early childhood (41). Other health related
indicators associated with PA in toddlers are bone health (9, 10). In addition, cognitive development (i.e. language development, development of reasoning skills, development of critical thinking skills) which begins to occur during toddler years, has also been shown to be positively associated with gross motor skills (e.g., walking, running, hopping) and by extension PA that incorporates gross motor activities (11). Finally, psychosocial health is an important aspect of early childhood and has been shown to have some connections with PA that warrant future inquiry (42). One systematic review that looked at PA, sedentary time and psychosocial well-being found that PA was positively associated with good psychosocial well-being (e.g., social competence, classroom behaviors) and that sedentary time was negatively associated with psychosocial well-being (12).

Due to the unique confluence of formative factors at this age, toddlers are at an important crossroads when it comes to developing PA related behaviors. Although it is only one important aspect of development, PA has shown throughout several studies to be associated with a variety of beneficial health outcomes (1, 12). Therefore, it is imperative that children and especially, toddler aged children, who are at a unique period of development meet the suggested PA recommendations to reduce the health risk associated with lack of PA and excessive sedentary time. PA recommendations for toddler aged children in the United States were not addressed in the newest 2018 PA guidelines for all Americans (43). However, two other analogous countries (Canada and Australia) have published PA guidelines for toddlers. Both the Australia and the Canadian department of public health recommends that toddlers should accumulate 180 minutes per day of total PA (activities range from light to vigorous intensity) (15, 16).
There is data to show that most toddlers are not accumulating the recommended amount of PA.

During a 24-hour objective assessment of PA, Vanderloo et al., found that analysis of toddlers’ PA using the Trost et al., cut-points showed that only 17.5% of the sample met the 180 min per day PA guidelines (19). Observational studies of toddler PA during childcare found that toddlers spend 22.2% of the childcare day engaged in PA behaviors (23). Worryingly this same age group also spends excessive periods of time in sedentary behavior, this is due to a confluence of many factors. For instance, due to limited mobility at the toddler age, caregivers may elect to transport children via a stroller while outside. Further, while in childcare services, children are required to be sedentary as part of regularly scheduled programming (e.g., circle time, snack time, music time). PA role models are crucial to young children’s development, not only do children learn through mimicking behaviors, analysis of barriers and facilitators of toddlers PA has suggested that toddlers ability to interact with PA role models are important in their development of healthy PA behaviors that can track later into life (14).

Physical activity at childcare centers

It is evident that toddlers and preschoolers (2.9 – 5 years) spend a large proportion of their early life, engaged in sedentary behaviors (19, 39, 40, 44). Santos et al., found that in a sample of Australian Toddlers (n = 202) only 11.4% of the sample met the daily physical activity guidelines for time in sedentary activity (39). A cross-sectional study of toddler’s PA and sedentary behaviors by Vanderloo et al., found that toddlers spend between 37.3 - 49.4 minutes per hour being sedentary over the course of a 7-day
assessment (19). Much of this could be because children spend a large portion of their day in childcare, which is a predominantly a sedentary environment. An objective analysis of children attending preschool centers by Ellis et al., used activPALs to assess sedentary time of 1 – 5 year-old children (n = 550) in Australia. Children in their sample spent 48.4% of the day sitting while at childcare (23). A separate study by Carson et al., found that in a sample of toddlers and preschoolers ( n = 114); children spent on average of 36.9 minutes per hour engaged in sedentary behaviors while in the childcare setting (44). Researchers also found that children in the same study spent on average 18.4 minutes per hour engaged in light PA (LPA) and only 4.2 minutes per hour engaged in MVPA (44).

The relationship between toddler activity and sedentary times is complex and can be different among centers, because of unique environments and differing center programs and policies. Bruijns et al., found that while toddlers tended to exceed the 180 minutes per day recommendation for PA they still spend a large proportion of their day (337.0 minutes per day) in sedentary behaviors (22). The exact meaning of this is currently unclear, the researchers hypothesized some reasons for this including the heterogeneity of the current sample of literature (22). Another possible explanation for this is the difference in sampling techniques used or accelerometer cut-points selected (22). The meta-analysis also noted that while toddlers tended to exceed the recommended 180 minutes per day in 75% of the studies reviewed toddlers failed to meet recommendations for MVPA (>60mins per day) (22). This may be because center policy or activities related to the childcare program, such as circle time or indoor play are not conducive to PA (especially MVPA) or because some centers lack the physical space to
facilitate indoor activity. In addition, differing center policy may affect the amount of time children have to engage in PA. For example, a center that lacks indoor play space, but off-sets this by providing ample outdoor activities can offset some of the negative effects of the lack of indoor space. Centers that lack access to space or outdoor activities, cannot provide the same access to PA as centers who have ample physical space or whose programs allow for outdoor recreation. Therefore, a program which increases total PA as well as MVPA is needed to facilitate children meeting PA recommendations.

Early evidence from the “GET-UP” study indicates that childcare centers with good program structure, including; schedules, free-play and group play activities may help mitigate the amount of sedentary time toddlers engage in while in the childcare setting (45). The GET-UP study also demonstrated that centers with a balance of indoor and outdoor play mitigate the sedentary effects of childcare centers on toddlers behavior (45). Supporting this notion others have researched toddler sedentary time during indoor free play. Researchers found that toddlers at childcare centers have reported higher sedentary behaviors during free play particularly while indoors (21). At least one study has shown that childcare providers may be unaware of how sedentary toddlers are while in childcare (46). So, while children may engage in a lot of sedentary behavior while at center-based care, interventions that target PA may have success in changing children behavior at toddler care centers. Toddler care providers, due to their custodial role could fill an important mode as role models of PA for toddler age children.

Hesketh et al., assessed provider perceptions of toddler PA during the childcare day. Researchers found that a large portion of provider assessed believed that toddlers required 45 minutes a day of PA (26). While, less than 33% of assessed providers believe
that toddlers required more than 90 minutes a day of PA while at the child care center (26). Findings from the same study reported that 97% of providers believed it was their job to make sure children were engaging in the proper amount of PA (26). So, while toddlers may engage in a disproportionate amount of sedentary time while at the childcare center, it is clear providers did believe it was their responsibility to provide an avenue for these children to participate in more PA while in their care.

Classroom Based Physical Activity Interventions in Toddlers

Past studies have highlighted the effectiveness of interventions designed to increase PA in preschool children (47). Although toddlers and preschoolers both spend significant portions of their day in non-parental childcare (48), differences in daily routines and environments, as well as gross motor skills, cognition and psychosocial behaviors, implies different needs for PA intervention in toddlers and preschool-age children (14, 45, 49). Meaning that PA programs which may work in toddler aged children. To date few PA programs have been designed and implemented solely for toddler aged children within the childcare setting.

In a 2014 study by Benjamin Neelon et al., researchers examine the efficacy of an intervention (Baby NAP SACC) designed to improve center level nutritional and PA policies and practices in infants and toddlers (31). In this study, researchers allowed center providers to pick several changes to center environment using a self-assessment tool. The toddler PA intervention consisted of the following 1) providers encouraging children to be physically active, 2) providers making positive comments about children being physically active, 3) providing toddlers with more than 20 minutes of PA every
hour while in childcare, 4) not restrict toddlers to sedentary behaviors for more than 30 minutes every hour with the exception of napping, and 5) providing toddlers with outdoor time and activities. Then with the help of trained interventionists, providers worked to implement these changes over a six-month period, the intervention was then piloted in 19 childcare centers across North Carolina (50). Changes in center environment and behavior were measured at baseline and post using the Environment Policy Observation and Assessment (EPOA) tool. In summary, the Baby NAP SACC study found that intervention enrolled centers changed EPOA scores over a six-month period, this was driven by changes in PA EPOA scores. Researchers mentioned that future studies should provide child-level outcomes as specific measures (31).

Another promising program was an 8-week randomized control trial by Veldman et al., that investigated the effects of a gross motor skills intervention in toddlers (n = 72) and found significant improvement in the motor skills of the intervention group (34). The 8-week intervention was implemented 5 days per week and focused on movements such as balancing, kicking and the broad jump. The Test of Gross Motor Development-2nd edition was used to assess any changes to gross motor skills over the course of the program (51). This study had high (>90%) participant retention rate, high provider participation rate, and the provider training sessions were successful implemented. Provider development sessions were fully implemented with attendance above 70% of total providers (34). The program was favorably rated by participating providers, indicating good attitudes towards implementation of PA in the childcare setting (34).

Process Evaluation
In order to discern best practices when it comes to incorporating PA into the classroom setting, early education providers need programs based on sound science. In addition, in order for researchers to determine how effective an intervention is in changing health behaviors it is critical to know factors such as if the intervention was implemented as design or if the dosage of the intervention matched what was originally intended. Implementation can be considered through a variety of process evaluation variables. Within process evaluation measures, it is critical to assess variables such as fidelity, dosage, quality, participant responsiveness, control condition monitoring, program reach, and adaptation. Fidelity is defined as how well the intervention followed the original intervention plan. Dosage is defined as how much of the intervention plan was delivered. Intervention quality assesses if all the components of the intervention were delivered clearly and correctly (i.e., directions were understandable to toddlers and followed the previously agreed upon lesson plan). Participant responsiveness is defined as the degree to which the intervention held the attention and interest of the participants. Control group monitoring is defined as the tracking of the attention and services provided within the control group. Program reach is defined as the attendance and participation rates of the participants. And adaptation, which is defined as modifications made to the original intervention implementation plan (36).

PA intervention studies in preschool-age children have shown that process evaluation data does provide unique information on why an intervention works or does not work (36, 49). For example, in 2016 our lab implemented an intervention in preschool-age children that was not effective in changing PA (52). Analyses of the process evaluation data indicated that both the fidelity and the dosage of the intervention
were low, and the intervention was not implemented as designed. This example illustrates that there are many factors that can influence the outcome of interventions. Due to this, it is crucial that researchers collect process evaluation data concerning the implementation of PA intervention.
CHAPTER III
METHODS

Introduction

The purpose of this study was to examine the feasibility and acceptability of a PA program in toddlers. The sample for this study was drawn from a PA intervention implemented within the childcare setting by research staff and trained classroom early education providers TAP (Toddler Activity Pilot). Three childcare centers within the Pioneer Valley of Western Massachusetts were recruited to participate in this study. After the completion of baseline data collection, the intervention was implemented 10 minutes per day, four days per week for 10 weeks. Researchers were responsible for implementing the intervention Monday and Tuesday. During the Wednesday session researchers and providers implemented the intervention together. Then on Thursday providers implemented the intervention alone with minimal assistance from researchers. Study outcome variables of interest were assessed throughout the 10-week study. Study design is presented in Figure 1.

Participants and Randomization

Childcare Centers and Randomization

The Massachusetts Department of Early Education and Care regulations define toddler age as 15 months to 2.9 years of age (53). Childcare centers (n = 3) with similar policies and environments related to PA were recruited from the Pioneer Valley of Western Massachusetts to participate in this study. Centers were eligible for participation if 1) they had at least two toddler classrooms, 2) had childcare providers willing to
implement the intervention, and 3) were willing to have research staff in the classroom to interact with the toddlers. Centers were randomized using a random number generator. For randomization, centers were first assigned a number (e.g., 1,2,3) the first two numbers to appear in our random number generator were assigned to the intervention (TAP) group. The remaining center was assigned to the control (CON) group.

Figure 1: 10 Week Study Design

Participants

Within each center, all toddlers participated in their assigned center intervention activities. However, individual participants were recruited to participate in the assessment portion of the study (e.g., height, weight, accelerometer, direct observation). Participants were eligible to participate in the assessment portion of the study if they 1) were in the toddler classroom at one of the participating childcare centers, 2) were between the ages of 18 months and 2.8 years of age at baseline data collection, and 3) had one parent willing to complete baseline demographic survey in English. Although the Massachusetts
Department of Early Education and Care defines toddlers as children at least 15 months of age, in this study, children were required to be at least 18 months of age to ensure that they had started developing the locomotor skills necessary to participate in the intervention. Participants were excluded from the assessment portion of the study if they 1) had a condition limiting their ability to participate in the intervention (e.g., not able to participate in PA or outdoor play activities), 2) had a condition limiting their ability to participate in assessment (e.g., unable to wear accelerometer), or 3) if their parent(s) was not able to read and complete the consent documents in English. Additionally, participants were excluded from the study if they would be moving into a preschool classroom by the end of the study (10 weeks). This study was approved by the University of Massachusetts Amherst Institutional Review Board.

Recruitment

Participants were recruited from three childcare centers from the Pioneer Valley area of Western MA, using recruitment strategies that have been previously employed by the Pediatric Physical Activity Laboratory (PPAL lab). Prior to face-to-face recruitment, study flyers (Appendix A) were placed in the cubby of all toddlers within the participating centers with information about the study. For face-to-face recruitment, both graduate and undergraduate students from the PPAL were present at the childcare centers during pick-up time (2:45 pm-5:30 pm), during which time they handed out study flyers and answered questions from parents about study requirements and eligibility.

Experimental Intervention
**Intervention Theoretical Framework**

Development of the intervention was based on the Social Ecological model (SEM). SEM is a multi-leveled theoretical framework used to children behavior (5). The SEM framework acknowledges how the complex intersection of relationships: individual, interpersonal, organizational, community, and policy helps in determining an individual’s behaviors, in this case PA and sedentary behaviors. The intervention utilized in this study focuses on the intersection between organizational, interpersonal, and individual constructs of SEM. In our intervention, organizational factors (e.g., childcare center environment related to PA and scheduling), interpersonal factors (e.g., training providers in PA, childcare provider self-efficacy in PA, PA knowledge), and individual factors (e.g., toddler exposure to fun PA programs and role models) all play a role in shaping the PA of toddlers. Using this model our lab designed an intervention aimed at altering toddlers PA and sedentary time while in the childcare center as depicted in figure 2.

**Figure 2: Theoretical Model of Proposed Intervention**
**Intervention Development**

PPAL researchers developed an intervention based on activities from the *Sports Play and Active Recreation for Kids* (SPARK) PA curriculum for preschoolers (54). The SPARK curriculum provides age-appropriate activities for preschoolers that includes games such as dance based and gross motor skill activities. PPAL has previously used the SPARK curriculum to alter PA in preschoolers within the childcare center by changing outdoor playtime structure (55). PPAL research staff utilized the intervention activities from the preschool pilot study as the starting point to create the Toddler Activity Program (TAP) intervention. In developing the current intervention, researchers focused on 1) making the activities age and gross motor skill appropriate for toddlers and 2) making sure the activities could be implemented within the limited space of the toddler classroom environment. Overall, 21 unique PA routines were developed. Each PA routine was designed to be 10 minutes in duration, which includes the warm-up (~2 – 3 minutes), moderate-to-vigorous movement session (~6 – 7 minutes), and cool-down/stretching (~ 1 minute). The warm-up portion consisted of a short dance routine based on the song *Shake, Shake, Shake*. The PA intervention routines varied throughout the study and some intervention activities included equipment such as a large parachute which was used to play popcorn (several bean bags were bounced around in the parachute). While other activities required no equipment and required the children to run around the classroom (e.g., *Fishy Fishy Cross my Ocean*). Following the moderate-to-vigorous movement session, a short 1 minute stretch and deep breathing cooldown was to be performed to calm the children and ready them to return to classroom activities. After the development of the intervention activities, research staff met with the directors and toddler classroom
providers of the participating childcare centers to go over the intervention activities to get their input of appropriateness of the developed intervention activities. Provider’s feedback and input were used to modify the intervention prior to implementation. During the 10-week intervention, each PA routine was used approximately twice.

**Intervention Implementation**

Research staff met with childcare providers to go over the intervention activities, implementation protocol and the assessment protocol. Intervention sessions were implemented during the morning classroom time for 10 weeks, 4 days per week, for 10 minutes per day (Monday – Thursday) using the train-the-trainer model. Trained interventionists implemented the intervention activities on Monday and Tuesday with the assistance of childcare providers. On Wednesday’s research staff and providers co-implemented the intervention activities. At the end of the Wednesday intervention day, the interventionist met with the classroom providers to determine which of the intervention activities that were implemented in the previous three days they would like to implement on Thursday. Finally, on Thursday, providers were asked to implement the intervention by themselves with minimal assistance from the research staff. However, research staff were present and helped as needed to facilitate the lesson. The control childcare center was asked to maintain their usual childcare center program and to not alter their PA environment or policy for the duration of the intervention. Upon the completion of the study intervention and all data collection and analysis, the control childcare center will receive the full intervention program.
Intervention Equipment

Equipment for the 10-week intervention was provided by the PPAL lab for center use and was provided to the intervention and control schools for use after study completion at no cost. Hula hoops and poly spots were used during the intervention to help children identify spots they should stand or move to, while parachutes were used for games such as “popcorn” or “carousel”. Research staff was trained in proper implementation using the supplied equipment and providers were taught during the week by research staff (Monday-Wednesday).

Researcher and Provider Training

Research staff members were trained in the intervention protocol prior to the start of the study. A manual of operating procedures was developed for the study that research staff could refer to at any point that staff had questions regarding proper procedures. Additionally, research staff were trained weekly (on Fridays) for proper procedures for the following week. Research staff responsible for the semi-structured questionnaires were instructed to be non-intrusive as much as possible and only assist in the implementation of intervention activities if necessary. Those that were responsible for observing the intervention were trained to recognize if the intervention was implemented correctly during the weekly lab meetings. Finally, providers were trained prior to the start of the intervention and during the week by research staff to properly implement the TAP intervention activities.

Measurements
All assessment took place at the participating childcare centers. Trained data collectors completed all data collection. Table 1 provides a list of all variables of interest and the time point when each was assessed.

Table 1: Measurement Schedule for outcomes and covariates

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>5 Weeks</th>
<th>10 Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process evaluation data</td>
<td>Weekly throughout 10-week intervention. See Table 2 for details.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Secondary Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical activity via accelerometer</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Physical activity via OSCAR-P (direct observation)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Covariates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demographics (parent report)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child’s anthropometrics</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Demographics and Physical Measures

Toddlers’ demographic information (i.e., child’s sex, race/ethnicity, parental income) was assessed using a parental survey at baseline (Appendix B) this was administered via Qualtrics (Qualtrics, Provo, UT) an online survey software. Parents were sent a link to enable them to complete the demographic survey during the baseline data collection period. Researchers sent two email reminders to remind parents to complete the baseline survey. Parents who did not have internet access or preferred paper
copy were provided with a paper copy of the survey. As part of the parent survey, parents were asked to report on the amount of sedentary behavior (e.g., screen time, quiet time, reading) that their child engages in during the weekday and weekend day, in the morning and evening time. Questions regarding sedentary behavior and screen time can be found in (Appendix C).

Toddlers height and weight were assessed at baseline and post intervention. Classroom providers were asked to assist research staff in assessing participants physical measures. Height was measured using a portable stadiometer (Shorr Height Measuring Board, Olney, MD). Participants’ height was assessed with shoes removed, with the participants standing with their backs and heels against the board, feet together, and head placed neutrally so the lower level of the orbit is parallel to the floor. Height was measured to the nearest tenth of a cm. Weight was measured using a digital portable scale (Scaletronix 5125, White Planes, NY). Either research staff or providers removed participants shoes and any bulky clothing interfering with measurement. Toddlers were asked or picked up and placed onto a taped “X” mark on the scale and weight was recorded to the nearest tenth of a kg. For toddlers that were not willing to stand on the scale, classroom providers were weighed first and then providers were asked to pick up and carry the toddler to be weighed together. Toddler’s weight was then calculated as provider plus toddler weight minus provider alone weight. Height and weight were measured at least twice and was measured in an alternating order (i.e., weight measurement #1, height measurement #1, weight measurement #2, height measurement #2). A third measurement was taken if the difference between the first two readings was
greater than 0.5 cm for height and 0.3 kg for weight. A copy of the anthropometrics measurement data sheet can be found in (Appendix D).

**Primary Outcome Variables: Process Evaluation Data**

The primary outcome variables of interest consisted of several process evaluation measures and were assessed using semi-structured questionnaires (Appendix E, F, and G). Process evaluation questionnaire were completed by trained members of the research staff each day the intervention was implemented throughout the study. Research staff observed the intervention for the 10-minute duration and completed the semi-structured questionnaire by the end of the intervention activities. The semi-structured questionnaires were paper forms created by the research staff prior to the start of the study and were printed daily for each classroom. Due to the study design, different semi-structured questionnaires were used to assess the intervention days that were be led by the research staff (Monday – Wednesday, Appendix E) and by the childcare provider (Thursday, Appendix F). A separate semi-structured questionnaire was used to assess process evaluation measures in the control childcare center (Appendix G).

**Table 2. Primary Outcome**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Example</th>
<th>Assessment</th>
<th>Time Point</th>
<th>Assessed By:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fidelity</strong>: Does implemented intervention match the originally intended program?</td>
<td>Adherence, integrity, replication</td>
<td>Questionnaire</td>
<td>Daily</td>
<td>accelerometers</td>
</tr>
<tr>
<td></td>
<td>Intervention intensity compliance</td>
<td>Accelerometer</td>
<td>Weekly</td>
<td>Accelerometers</td>
</tr>
<tr>
<td>Program Reach</td>
<td>Participation rates</td>
<td>Center attendance records</td>
<td>Daily</td>
<td>Provider</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------</td>
<td>----------------------------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>Dosage:</strong> How much of original program is delivered?</td>
<td>Quantity</td>
<td>Questionnaire</td>
<td>Daily</td>
<td>Research staff</td>
</tr>
<tr>
<td><strong>Quality:</strong> Were all components of the intervention delivered clearly and correctly?</td>
<td>Delivery</td>
<td>Questionnaire</td>
<td>Daily</td>
<td>Research staff</td>
</tr>
<tr>
<td><strong>Monitoring of Control</strong></td>
<td>INT contamination</td>
<td>Questionnaire</td>
<td>Daily</td>
<td>Research staff</td>
</tr>
<tr>
<td><strong>Adaptation</strong></td>
<td>Program modification</td>
<td>Questionnaire</td>
<td>Daily</td>
<td>Research staff</td>
</tr>
<tr>
<td><strong>Program satisfaction</strong></td>
<td>Program acceptability</td>
<td>Questionnaire</td>
<td>Post-study</td>
<td>Provider Questionnaire</td>
</tr>
</tbody>
</table>

**Feasibility:**

For this study, feasibility was defined as participant recruitment, retention, and toddlers’ ability to wear the accelerometer. Our goal was to recruit $\geq 70\%$ of the total toddler population of the childcare centers. Our goal for retention was $>75\%$ retention of toddlers enrolled in the research study at 10-week data collection. Retention was assessed at each time point (baseline, midpoint, Post 10-week INT). In addition, research staff noted if children left the childcare center or were moved to other classrooms. Finally, researchers examined the number of times that children wore their accelerometer during the intervention time and during the three assessment timepoints. Children were marked as non-compliance if they did not wear their accelerometer during the entire intervention session or removed their belts for any reason during the three assessment timepoints.
Fidelity

Study fidelity (extent to which the intervention was implemented as originally designed) was assessed utilizing the semi-structured questionnaire (Appendix E & F) and focused on intervention adherence, compliance, integrity, and replication (Monday-Thursday). During each intervention day, research staff used the questionnaire to obtain information for several variables such as intervention adherence (number of children that participate in the intervention), integrity (if the intervention was implemented as originally designed), and replication [if all components (i.e., warm-up, lesson, cool-down)] were implemented as design.

Dosage of the intervention

Program dosage was assessed with a semi-structured questionnaire (Appendix E & F). In order to assess actual dosage of the intervention, research staff recorded information on the start and stop times of each 10-minute intervention session. Researchers also assessed the dosage of the intervention by comparing the planned intervention schedule to any alterations that had to be made (e.g., missed days, alterations to program planned activities, alterations in time due to scheduling conflicts).

Quality

The quality of the intervention was assessed with a semi-structured questionnaire (Appendix E & F). As part of this questionnaire, trained research staff members described if the intervention session was delivered clearly and correctly daily (Monday-
Thursday) (i.e., directions were understandable to toddlers and followed the previously agreed upon lesson plan). Research staff also noted any comments made by research staff or childcare providers about the general quality of program delivery by interventionists.

Program adaptation

Any adaptations that occur to the program were assessed with the semi-structured questionnaire (Appendix E & F) to determine if any changes had occurred to alter the originally designed intervention. Research staff members were asked to record detailed notes describing the adaptation that occurred and the reason why. Researchers also asked providers to comment on how the intervention can be adopted better at the end of study in the provider survey (Appendix H).

Acceptability

Acceptability was assessed using the process evaluation semi-structured questionnaire (Appendix E & F) completed by research staff and post study evaluation forms completed by childcare providers (Appendix H). Researchers answered daily questions about the perceived enjoyment of intervention activities by toddlers. Researchers also answered daily questions about provider participation and perceived enjoyment of intervention activities was assessed in the final survey completed by providers. Researchers also assessed providers satisfaction with various parts of the program including timing of the intervention session, the duration of the intervention, the content of the interventions, and the intervention implementation schedule. Researchers assessed providers perception of how our intervention impacted classroom behavior;
immediately following the intervention, at other times during the toddler school day and over the course of the 10-week intervention. Finally, researchers assessed the likelihood of providers continuing to use intervention activities during the morning/circle time or at other points during the school day.

Intensity

Intervention intensity was assessed using Actigraph accelerometers (GT1M, GT3X, GT3X+BT; Actigraph, LLC, Pensacola, FL) and direct observation by trained researchers using the observational system for recording physical activity in children preschool (OSRAC-P) (4). On one randomly selected day per week, accelerometers were worn on an adjustable elastic belt around the waist of the participant and placed on their lower back to be unobtrusive. Accelerometers were placed on children at the start of the intervention and removed at the end of the 10-minute intervention time. Accelerometers were initialized to record data every 15 seconds epoch. Trost et al., cut-points for toddlers will be used to convert the counts into PA intensity (sedentary time = 0 - 48 counts per minute; light PA = 49 - 418 counts per minute; moderate-to-vigorous PA = >418 counts per minute) (25)

Toddler s PA were also assessed via direct observation during the intervention session for baseline and 10-week post intervention data assessment. For direct observation a modified version of the observational system for recording physical activity preschool (OSRAC-P) was used (56). Researchers modified OSRAC-P to include activities that toddlers were more likely to engage in (e.g., creeping, rolling). For each time point, 18 toddlers were assessed. Researchers observed each toddler for a total of
five minutes (15-seconds observed intervals followed by a 15-second record interval). During the observation intervals, toddler’s activity was coded as either stationary, stationary with limb movement, slow-easy, moderate, or fast. For analysis, recorded observation data was reduced to percent interval spent in each activity intensity type [sedentary (stationary and stationary with limbs), light (slow-easy), and moderate-to-vigorous (moderate and fast)]. Researchers that were responsible for direct observation received proper training prior to the start of the intervention and were instructed to be minimally intrusive during intervention activities.

Monitoring of Control Center

The control center received a PA monitoring program to track classroom activity and program structure. Research staff were asked to record outcome variables of interest during a 10-minute observation period. Researchers recorded the location of the observation, the category of activity offered (Unstructured, Structured, Combination). As well as other information about the observed activity such as, what was the activity? Was the activity structured or combined? How many students participated in the activity? Was PA incorporated into the activity, if so what was the estimated intensity? Research staff also asked classroom providers if there were any planned PA lessons throughout the day? Finally, toddler PA levels were assessed in the control school using Actigraph accelerometers. For information regarding control school monitoring forms see Appendix G.

Statistical Analyses
The purpose of this study was to examine the feasibility and acceptability of a 10-week PA randomized control trial. For demographic information, means and standard deviation were calculated for the sample. Mean and standard deviation were also reported for both intervention and control centers for the number of times that children wore their accelerometer. For dosage, start times, end times and average length of intervention, mean and standard deviation for the 10-week study were calculated for the intervention centers for both researcher (Appendix E) and provider (Appendix F) led interventions. Mean number of children enrolled in the study that participate in the intervention were calculated for researcher (Appendix E) and provider (Appendix F) led interventions activities. Researchers also calculated the mean and standard deviation of the observations missed for each center. To examine the intervention fidelity researchers compared the intervention center time spent in LPA and MVPA during the 10-minute intervention to the CON center time spent in LPA and MVPA during a comparable 10-minute observation window. Researchers used accelerometer data for comparison. Data analysis was conducted using R studio (Version 1.3.1073, PBC, Copyright: 2009-2020). Below are our analysis plan for each study aim.

**Aim 1:** To examine the feasibility of a 10-week PA program in toddlers. For this study, feasibility was defined as participant recruitment and retention and toddlers’ ability to wear the accelerometer.

H1a: Participant recruitment will exceed 70% of the total toddler population of the childcare centers. Participant retention will be 75% at 10-week data collection.

**Analysis Plan:**
▪ Frequencies to determine if recruitment and retention goals were met.
▪ Researchers noted if students left the school or move to a preschool classroom.

H1b: At each assessment timepoints, at least 75% of participants will wear the accelerometer for the duration of the intervention time and during the childcare day.

Analysis Plan:
▪ Frequencies to determine number of kids that wore accelerometer during the intervention session and at each timepoint.
▪ Wear time analysis to determine the approximate minutes per day toddlers wore their accelerometers at baseline, midpoint and post.

Aim 2: To examine the fidelity of a 10-week PA program in toddlers. For this study, fidelity was defined as intervention integrity (number of original PA lesson implemented as designed) and intervention intensity (time spent during the intervention that was ≥ light intensity PA).

H2a: For intervention integrity, we hypothesize that at least 80% of the interventions will be implemented as designed.

Analysis Plan:
▪ Means and standard deviation were calculated for provider and researcher process evaluation variables (semi structured questionnaire) and frequencies were calculated for categorical variables for provider and researcher process evaluation metrics.
Researchers noted any changes to the program and representative quotes were collected for qualitative variables.

H<sub>2b</sub>: For intervention intensity, we hypothesize that participants will engage in at least 50% more total activity during the intervention time. MVPA, LPA and SED will be examined separately.

**Analysis Plan:**

- Means and standard deviation were calculated for accelerometer data during the 10-minute INT and the 10-minute observation period in the control school.

H<sub>2c</sub>: For intervention dosage, we hypothesize that >80% of lesson plans will be implemented.

**Analysis Plan**

- Means and standard deviation for the timing of the intervention for both researcher and provider led interventions.
- Frequencies were calculated for categorical variables such as if all parts of the program were implemented.
- Researchers noted the number of lessons missed and reasons for missing the intervention.

H<sub>2d</sub>: For program quality, we hypothesize that >80% of lessons will be implemented clearly and correctly.

**Analysis Plan**

- Means and standard deviation for continuous variable and frequencies for categorical variables were calculated.
\( H_2e: \) We had no specific hypothesis for adaptations, this is because adaptations were not foreseen changes to the program.

**Analysis Plan**

- Means and standard deviation for continuous variable and frequencies for categorical variables were calculated.
- Representative quotes were collected for qualitative variables.

**Aim 3:** To examine the acceptability (e.g., enjoyment and satisfaction) of a 10-week PA program in toddler childcare providers.

\( H_{3e}: \) We hypothesize that the childcare providers will have a high level of enjoyment and satisfaction with the PA intervention.

**Analysis Plan:**

- Means and standard deviation were calculated for continuous variables and frequencies were calculated for categorical variables.
- Representative quotes were collected for qualitative variables.
CHAPTER IV

RESULTS

Baseline Characteristics

The purpose of the TAP-A-Long Study was to examine the feasibility and acceptability of a 10-week PA program in toddler aged children during the childcare day. Participants baseline information is presented in (Table 3). Overall, data was collected in 50 toddlers. Study participants were male (58%), White (46%) and lived in a household with married parents (58%). The average age of the toddler population (n = 50) was 25.0 ± 4.2 months. The average toddler weight and height (length) was 12.9 ± 1.5 kg and 85.9 ± 4.5 cm, respectively. Based on these values, their average weight to age and length to age percentile was at the 33.4 and 9.2 percentiles, respectively, for their age and sex (57). A large proportion of the sample were from families with yearly incomes > $80,000 (52%).

Table 3. Participant baseline demographics and physical measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>TAP (n = 37)</th>
<th>CON (n = 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Months)</td>
<td>24.6 ± 4.0</td>
<td>26.0 ± 4.7</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>13.1 ± 1.6</td>
<td>12.4 ± 1.2</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>86.4 ± 4.0</td>
<td>84.5 ± 5.4</td>
</tr>
<tr>
<td>Sex (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>24 (64.9)</td>
<td>5 (38.5)</td>
</tr>
<tr>
<td>Female</td>
<td>13 (35.1)</td>
<td>8 (61.5)</td>
</tr>
<tr>
<td>Race/ethnicity (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>18 (48.7)</td>
<td>5 (38.5)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>5 (13.5)</td>
<td>0</td>
</tr>
<tr>
<td>Black/African American</td>
<td>4 (10.8)</td>
<td>3 (23.1)</td>
</tr>
<tr>
<td>Asian</td>
<td>1 (2.7)</td>
<td>2 (15.4)</td>
</tr>
</tbody>
</table>
Other & 1 (2.7) & 0 \\
\textbf{Marital Status (Parents) (%)} & & \\
Single/Never Married & 7 (18.9) & 1 (7.7) \\
Married & 21 (56.8) & 8 (61.5) \\
Divorced/Separated & 1 (2.7) & 2 (15.4) \\
\textbf{Income (%)} & & \\
Less Than $20,000 & 1 (2.7) & 2 (15.4) \\
$20,000-$39,999 & 1 (2.7) & 2 (15.4) \\
$40,000-$59,999 & 2 (5.4) & 2 (15.4) \\
$60,000-$79,999 & 2 (5.4) & 2 (15.4) \\
>$80,000 & 22 (59.5) & 4 (30.8) \\

\textit{TAP = TAP-A-Long intervention group; CON = control group.}

\section*{Feasibility}

Massachusetts Early Child Education Standards allows for a total of nine toddlers per classroom with two providers present (58). The TAP study included a total of three centers, two were randomized to the treatment group (TAP) and one was randomized to the control (CON). There was a total of five and three classrooms in the TAP and CON groups, respectively. Overall, there were a total of 45 and 27 toddlers that attended the TAP and CON centers, respectively. The maximum toddler population at the participating centers was 72 children. After 2 weeks of recruitment by trained researchers, a total of 50 (TAP, n = 37; CON, n = 13) toddlers were recruited and consented to participate in the data collection portion of the study. This represents a participants recruitment rate of 69.4\% of the total sample of toddlers.

For retention during the 10-week intervention, at least one full day of accelerometer data was completed in 47 toddlers (94.0\%) at baseline, 44 toddlers (88.0\%) at midpoint (5 week), and 45 toddlers (90.0\%) at post (10 week). One day was selected based on the analytical plan for the main study outcome and to include toddlers who only
attended the program for 3 days per week. Toddler average accelerometer wear time for all three assessment timepoints (baseline, week 5 and week 10) were 432.9 ± 42.4 minutes per day for the TAP group and 424.2 ± 33.3 minutes per day for the CON group. Wear time average for all assessment time points is presented in Table 4. On average, participants provided accelerometer data for an average of 3.4 days per week.

Table 4. Average accelerometer wear time (minutes per day)

<table>
<thead>
<tr>
<th>Time point</th>
<th>TAP</th>
<th>CON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>427.7 ± 42.5</td>
<td>416.6 ± 49.7</td>
</tr>
<tr>
<td>5 weeks</td>
<td>445.6 ± 22.4</td>
<td>428.7 ± 28.6</td>
</tr>
<tr>
<td>10 weeks</td>
<td>425.6 ± 62.3</td>
<td>427.2 ± 21.6</td>
</tr>
</tbody>
</table>

*Table 4.* Average accelerometer wear time (minutes per day)

TAP = TAP-A-Long intervention group; CON = control group.

To assess some of the processed evaluation outcome variables, participants PA levels were assessed with accelerometers during the 10-minute intervention session. These assessments occurred on one randomly selected day per week during weeks 1 - 4 and weeks 6 - 9. On average 65.6% of the participants in the TAP centers wore their accelerometers for the weekly PA assessment during the intervention session. Likewise, 66.3% of the participants in the CON center wore their accelerometers during the 10-minute observation window.

**Intervention Duration (Dosage)**

Average duration of the intervention was 10.31 ± 1.71 minutes per session for the researcher led and 10.81 ± 2.47 minutes per session for the provider led intervention. Of
the total intervention days, nine intervention days were missed due to holidays (n = 4 days), snow days (n = 2), and lack of available research staff (n=3).

**Intervention Session Intensity**

On average during the weekly accelerometry assessment (which occurred on one random selected day per week during the intervention session), the TAP centers spent 60.4 ± 22.0% in SED, 28.7 ± 15.7% in LPA, and 10.9 ± 10.6% of intervention time in MVPA (Table 5). This equates to 6.04 ± 2.2 minutes in SED, 2.87 ± 1.57 minutes in LPA and 1.09 ± 1.06 minutes in MVPA. On average during baseline (1 week) toddlers in the TAP group spent 74.6 ± 6.6% of the school day in SED, 20.4 ± 5.1% in LPA, and 5.0 ± 2.1% in MVPA. During 5-week midpoint toddlers in the TAP group spent 74.4 ± 4.9% in SED, 20.8 ± 4.2% in LPA, and 4.8 ±1.8% of the school day in MVPA. During the 10-week post intervention assessment toddlers in the TAP group spent 75.8 ± 6.7% in SED, 19.5 ± 5.1% in LPA, and 4.7 ± 2.4% of the school day in MVPA.

Direct observation of toddler PA was reviewed using a pre-post data analysis for comparison to accelerometer data. Corresponding direct observation data can be found in Table 6. Researchers found that at baseline toddlers spent 77.4% in SED, 22.2% in LPA, and 3.3% of observations in MVPA. At 10-week post intervention observation researchers found that toddlers 26.7% of time in SED, 37.8% of time in LPA and 33.9% of observations in MVPA.

**TABLE 5 Accelerometer Averages**

<table>
<thead>
<tr>
<th>Weekly Intervention Intensity (percent of intervention time)</th>
<th>TAP</th>
<th>CON</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Baseline</td>
<td>Post</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td></td>
<td>TAP</td>
<td>CON</td>
</tr>
<tr>
<td>SED</td>
<td>74.6% ± 6.6%</td>
<td>69.6% ± 5.0%</td>
</tr>
<tr>
<td>LPA</td>
<td>20.4% ± 5.1%</td>
<td>25.2% ± 2.9%</td>
</tr>
<tr>
<td>MVPA</td>
<td>5.0% ± 2.1%</td>
<td>5.2% ± 2.8%</td>
</tr>
<tr>
<td>SED</td>
<td>74.4% ± 4.9%</td>
<td>72.3% ± 7.1%</td>
</tr>
<tr>
<td>LPA</td>
<td>20.8% ± 4.2%</td>
<td>22.5% ± 4.3%</td>
</tr>
<tr>
<td>MVPA</td>
<td>4.8% ± 1.8%</td>
<td>5.2% ± 3.3%</td>
</tr>
<tr>
<td>SED</td>
<td>75.8% ± 6.7%</td>
<td>75.0 (±6.2)</td>
</tr>
<tr>
<td>LPA</td>
<td>19.5% ± 5.1%</td>
<td>20.8 (±3.9)</td>
</tr>
<tr>
<td>MVPA</td>
<td>4.7% ± 2.3%</td>
<td>4.1% ± 2.7%</td>
</tr>
</tbody>
</table>

TAP = TAP-A-Long intervention; CON = Control; SED = sedentary activity; LPA= light physical activity; MVPA= Moderate-Vigorous physical activity.
SED = Sedentary intensity; LPA = Light physical; MVPA = Moderate to vigorous physical activity

Process Evaluation Variables

Study process evaluation data (fidelity, quality, program adaptation, and acceptability) were collected via semi-structured questionnaires during the intervention time by trained research staff. A summary of study process evaluation outcome variables is presented in Table 7 & 8.

Fidelity

Toddler adherence to the TAP intervention was high for both researcher and provider led intervention sessions. For researcher-led interventions 89.5% of the toddlers were present during the intervention session. Provider-led intervention had similar attendance numbers with 86.7% of the toddlers present during the intervention session. Toddlers enrolled in the data collection portion of the intervention typically accounted for 59.3% of toddlers present for researcher and 59.3% for provider-led sessions. Due to the intervention program being offered to the entire center, classroom level data was recorded for intervention sessions. During researcher-led intervention sessions, an average of 78.8% of the toddlers participated in the lesson. For provider-led sessions, an average of 67.0% of the toddlers participated in the lesson. Only 37.3% of researcher-led interventions were implemented as originally designed, while 56% of intervention sessions delivered by providers were implemented as designed. Modifications to the
intervention were undertaken to improve intervention implementation. For example, researchers sometimes changed the order of intervention activities or made activates easier for toddlers to follow or shortened the duration of individual activities. Although researchers implemented only 37.3% of interventions as designed, often changes to delivery of the program was made while still implementing all of the planned components. During the researcher-led intervention sessions, 64.7% of all the planned components (i.e., warm-up, lesson, cool-down) were implemented as designed compared to only 58% of the time in the provider-led sessions.

Quality

Researchers delivered the intervention clearly (i.e., directions were understandable to toddlers) 76.7% of the time, while providers delivered the intervention clearly 62% of the time (see Table 7 & 8). Researchers delivered the intervention correctly 45.3% of the time, and providers delivered the intervention correctly 54% of the time. Common reasons the program was not delivered as intended by researchers included: 1) the session exceeding the planned 10-minute duration; 2) repeating the same activity twice because toddlers enjoyed that portion of the program and thereby eliminating the cool-down segment, or 3) researchers removed some activities due to lack of space or research staff for safe implementation of certain activities. Reasons for the program not being delivered as intended by providers included: 1) the providers being uncomfortable leading the intervention session; 2) missing portions of the program due to time constraints, or 3) portions of the program not being implemented due to confusion among toddlers.
Program Adaptations

The TAP program was created with childcare providers and was meant to be flexible to allow for modifications to be made to the intervention sessions. Therefore, researcher gathered data about modifications made to the intervention session by the interventionist (researcher or provider). Common modifications made to the TAP intervention by researchers included, holding toddlers’ hands while doing activities to help direct toddlers. Another modification made by researchers was to add music to sessions that lacked music to make sessions more entertaining for toddlers, modifying games to allow for safe movement by toddlers was another important factor that contributed to program changes. Modifications made by providers included allowing the interventionist to lead the intervention while providers focused on classroom management and modifying games because the children could not do certain movements (e.g., changing hopping to walking).

Acceptability

The TAP intervention was well received by both toddlers and providers. For researcher-led sessions, the intervention appeared to hold the majority of toddlers’ interest 70.7% of the time and for providers 60% of the time. During the researcher-led intervention session, at least one provider participated 75.3% of the time, while both providers participated 44% of the time. Data from the post-intervention questionnaire completed by providers showed that the intervention was generally well received by providers, and they felt the intervention was also well received by the toddlers. For
example, one provider stated “It [intervention] helps the children get out any energy they may have early in the day.” Another provider stated, “Activities were well received by the kids. Music choices are good. Activity level and organization was good.”

TABLE 7. Researcher-led process evaluation outcome (n = 150 observations)

<table>
<thead>
<tr>
<th>Question</th>
<th>MEAN ± STD DEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>All toddlers present during intervention?</td>
<td>8.1 ± 1.1</td>
</tr>
<tr>
<td>Among consented toddlers - how many in attendance?</td>
<td>5.3 ± 2.0</td>
</tr>
<tr>
<td>Number of toddlers participating in intervention?</td>
<td>7.1 ± 1.6</td>
</tr>
<tr>
<td>Approximate minutes that majority of toddlers participate in intervention?</td>
<td>8.4 ± 2.4</td>
</tr>
<tr>
<td>Number of times instructor provided positive encouragement?</td>
<td>9.0 ± 4.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes (%)</th>
<th>No (%)</th>
<th>Missing (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did at least 50% toddlers participate?</td>
<td>74.7</td>
<td>2.7</td>
<td>22.7</td>
</tr>
<tr>
<td>Did majority of toddlers participate in at least half?</td>
<td>71.3</td>
<td>6.0</td>
<td>22.7</td>
</tr>
<tr>
<td>Did the majority toddlers seem to enjoy session?</td>
<td>70.7</td>
<td>6.0</td>
<td>23.3</td>
</tr>
<tr>
<td>Did the intervention appear to hold the interest of the majority of toddlers?</td>
<td>70.7</td>
<td>6.7</td>
<td>22.6</td>
</tr>
<tr>
<td>Did childcare providers participate in intervention?</td>
<td>75.3</td>
<td>2.0</td>
<td>22.7</td>
</tr>
<tr>
<td>Did childcare providers seem to enjoy participating in intervention?</td>
<td>71.3</td>
<td>5.3</td>
<td>23.3</td>
</tr>
<tr>
<td>Did intervention leader provide encouragement?</td>
<td>76</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Intervention session implemented as intended?</td>
<td>37.3</td>
<td>40</td>
<td>22.7</td>
</tr>
<tr>
<td>Did intervention leader implement session clearly?</td>
<td>76.7</td>
<td>0</td>
<td>23.3</td>
</tr>
<tr>
<td>Did intervention leader implement intervention correctly?</td>
<td>45.3</td>
<td>32</td>
<td>22.7</td>
</tr>
</tbody>
</table>
Did intervention leader implement all of planned components? 64.7 12.7 22.7
Modifications/adaptations from original intervention? 39.3 38 22.7
Did intervention leaders recommend modifications or changes for future? 42 35.3 22.7
Did observation session go as expected? 52 24.7 23.3

<table>
<thead>
<tr>
<th>Question</th>
<th>MEAN ± STD DEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toddlers present during intervention?</td>
<td>7.8 ± 1.4</td>
</tr>
<tr>
<td>Among consented toddlers how many in attendance?</td>
<td>5.3 ± 2.4</td>
</tr>
<tr>
<td>Number of toddlers participating in intervention?</td>
<td>6.0 ± 2.3</td>
</tr>
<tr>
<td>Approximate minutes majority toddlers participate in intervention?</td>
<td>7.5 ± 2.6</td>
</tr>
<tr>
<td>Number of times instructor provided positive encouragement?</td>
<td>9.3 ± 5.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>YES (%)</th>
<th>NO (%)</th>
<th>MISSING (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did at least 50% of toddlers participate?</td>
<td>56</td>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>Did majority of toddlers participate in at least half?</td>
<td>60</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Did the majority of toddlers seem to enjoy session?</td>
<td>60</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Did the intervention appear to hold the interest of the majority of toddlers?</td>
<td>60</td>
<td>3</td>
<td>32</td>
</tr>
<tr>
<td>Did both classroom teachers participate?</td>
<td>44</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>Did intervention leader provide encouragement?</td>
<td>66</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>Intervention session implemented as intended?</td>
<td>56</td>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>Did the teacher implement the session clearly?</td>
<td>62</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>Did the teacher implement the intervention correctly?</td>
<td>54</td>
<td>14</td>
<td>32</td>
</tr>
</tbody>
</table>

TABLE 8. Provider-led process evaluation outcome (n = 47 observations)
Did the teacher implement all of the planned components?  58  12  30
Modifications/adaptations from original intervention?  8  62  30
Did the teacher recommend modifications or changes for future lessons?  6  64  30
Did observation session go as expected?  58  12  30

Control School Monitoring

Control school monitoring was conducted four days per week for the duration of the study. In the control school a total of twelve days were missed due to holidays (n = 4), snow days school cancelation (n = 2), and no data was collected (n = 6) due to lack of available research staff. The average length of the control center observation session was 10.2 ± 1.0 minutes. Table 9 provides the information collected via semi structured questionnaires by trained data collectors at the control center. The location of the observation was most commonly indoor (39.5%). Unstructured activity was the most observed category of activity offered (50.8%). For structured and combined activities, the providers were most commonly the leaders (24.6%). In addition, for structured or combined activities 69.0% of the classroom participated in the activities. Physical activity was commonly incorporated into the observed activities (53.8%). Common examples of structured activities in the control center included dancing and long walks. Common examples of unstructured activities included indoor and outdoor free play with toys. Combined activities often entailed combining unstructured activities like free play with structured activities such as reading. During once weekly accelerometry assessment, the control center spent 55.7 ± 18.8% of their time in SED, 35.9 ± 15.1% in LPA, and 8.4 ±
8.0% of their time in MVPA. During weeklong accelerometry assessment that occurred at baseline, control center toddlers spent 69.6 ±5.0 in SED, 25.2 ± 2.9% in LPA, 5.2 ± 2.8% in MVPA. Similarly, during 5-week (midpoint) assessment control toddlers spent 72.3 ± 7.1% in SED, 22.5 ± 4.2% in LPA, and 5.2 ± 3.3% in MVPA. For 10-week (post) intervention assessment control school toddlers spent 75.0 ± 6.2% in SED, 20.8 ± 3.9% in LPA, and 4.1 ± 2.7% in MVPA.

Table 9. Control center process evaluation outcome

<table>
<thead>
<tr>
<th>Question</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the location of the intervention?</td>
<td>Indoor</td>
</tr>
<tr>
<td></td>
<td>39.5%</td>
</tr>
<tr>
<td>What was the category of activity offered?</td>
<td>Structured</td>
</tr>
<tr>
<td></td>
<td>4.2%</td>
</tr>
<tr>
<td>Who led the observed activity?</td>
<td>Teacher</td>
</tr>
<tr>
<td></td>
<td>25.6%</td>
</tr>
<tr>
<td>If structured or combination was selected approximately what percentage of students participated?</td>
<td>69.0 ± 29%</td>
</tr>
<tr>
<td>Was PA incorporated into observed activity?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>53.8%</td>
</tr>
<tr>
<td>Are there any other planned activities throughout the day?</td>
<td>65.8%</td>
</tr>
<tr>
<td>Select category of PA that describes majority of students during observed activities?</td>
<td>MVPA</td>
</tr>
<tr>
<td></td>
<td>5.0%</td>
</tr>
</tbody>
</table>
CHAPTER V
DISCUSSION

Introduction

PA has been associated with a range of beneficial health outcomes in children as young as toddlers (1, 12). For example, PA has been reported to improve bone strength that tracks throughout childhood. (9). Current guidelines suggest that young children (< 5 years of age) should attain >180 minutes per day in a variety of activities and reduce their time spent sedentary activities (15). Despite these recommendations, there is data to suggested that few children actually meet these guidelines (39). One possible solution lies in changing PA behavior within settings where young children spend most of the waking hour, such as the childcare center. Unfortunately, within the childcare center studies have shown that young children tend to participate in mostly sedentary activities (23). In the United States, childcare centers are designed to provide care for both toddlers and preschool-age children. Currently, there have been numerous studies designed to improve the PA levels of preschool-age children. However, within the childcare setting very limited interventions have been implemented aimed at improving toddlers PA level. When PA interventions are implemented, rarely are information provided on the implementations process of these studies. The lack of information of the implementations processes of studies reduces our ability to determine why some interventions are effective while others are not effective. Therefore, the purpose of this study was to determine the feasibility and process evaluation of a toddler PA program implemented during the
childcare day. Due to the limited PA studies conducted in toddlers, when appropriate within this discussion, the study findings will be compared to what has been reported for preschool-age children within the childcare setting.

**Study Implementation Outcomes**

**Study Feasibility**

The primary aim of this study was to examine the feasibility of a 10-week PA program in toddlers. For this study, feasibility was defined as participant recruitment, retention, and toddlers’ ability to wear the accelerometer. For this study, we hypothesized that we would be able to recruit at least 70% of total toddler population. However, the study recruitment was slightly lower than expected, as we were able to recruit 69.4% of eligible toddlers and their families to participate in the study. Previous research in preschool-age children from our lab has found similar numbers. For example in a 2013 preschool PA pilot study our lab was able to recruit 56.0% of the eligible population spread across two childcare centers (55). Similar to the current study, the 2013 study from our lab had a short recruitment time frame. Other researchers have been able to recruit higher percentage of eligible participants to participate in their studies. For example, in a 10 week PA study by Trost et al., the researchers were able to recruit 87.5% of the total eligible preschoolers for the study (7). It is possible that the high recruitment rate by Trost et al., was due to the fact that the study took place in a single childcare center; therefore, researchers were able to concentrate all their resources to the single center.
In our present study, our inability to meet the study initial recruitment goals could have been due to factors such as the length of study recruitment phase (two weeks prior to baseline data collection) and the fact that some children were also consistently picked up from childcare center prior to the start time of daily recruitment session (3:30 pm). A potential solution would be to lengthen the duration of the study recruitment phase, provide morning drop off recruitment availability, or start the daily recruitment session early (i.e., 2:30 pm). All three recruitment strategies were considered for the current study; however, all were not possible. Lengthening the duration of the recruitment session was not possible due to two different childcare academic year activities. First, although the center academic year calendar started in last week of August, providers did not want research staff in the classroom while they worked on establishing classroom rules for the toddlers (whom have never been away from home). Second, the start of the 10-week study was planned so that the study data collection would be completed before the Christmas holiday season. Past research from our lab has shown low intervention implementation by providers during any type of holiday session (52). Concerning recruitment during morning drop off or the earlier start of daily recruitment sessions, providers did not want researchers in the classroom during the morning drop off period or early afternoon (2:30 coincides with kids just waking up from nap time) due to the disruption this could potentially cause with children who were just getting used to being away from their parents.

For study aim 1, we were also interested in examining our ability to retain the recruited participants for the duration of the study. We originally hypothesized a study retention of 75%. We were able to retain 91% of the recruited participants for the
duration of the study. This could indicate that provider and director buy into our program was high and thus encouraged toddlers to remain in our study for the duration of the 10 weeks. Of the total recruited participants, 8% (n = 4) were lost prior to the 10-week data collection. The observed retention rate of this study was similar to what have been observed in preschool-age studies. This was similar to past preschool studies from our lab, the same 2013 study mentioned previously had a 94% retention rate at post study assessment (55). Common reasons for loss to follow up was due to children leaving the childcare program or moving up to the preschool classroom prior to the 10-week data collection. In working in childcare centers, losing participants due to change of centers are unavoidable; however, future studies can mitigate loss to follow up through effective communication with childcare providers and toddler parents.

One of the barriers in objectively assessing PA accelerometers in young children as part of PA intervention studies has to do with their ability to wear the accelerometer (59). As previously stated, there have been very limited PA interventions studies conducted in toddlers due to this it is unknown if toddlers would be willing to wear the accelerometers for multiple days per week over multiple data collection time points. On average 91% of participating toddlers wore their accelerometers for the weekly PA assessment. For this study, accelerometer retention was defined as toddlers’ ability to wear and continue wearing accelerometers during assessment periods. Since toddlers can often be fidgety or be uncomfortable with unknow items on their personal body, our worry was that there may be a large amount of missing data due to accelerometer removal. In addition, during the center recruitment phase, both center directors and providers expressed concerns that the accelerometers could be uncomfortable for
toddlers. This however did not prove to be the case for most toddlers, once the accelerometer was placed on the toddler’s lower back, they (toddlers) continued to wear the accelerometer throughout the day with minimal removal necessary. Some toddlers would not allow researchers to place the accelerometer on them due to fear of strangers, but often would allow the providers to place accelerometers on them (toddlers). Therefore, many times providers assisted researchers in placing accelerometers on toddlers. This was beneficial for two reasons, one it sped up the process allowing researchers to better utilize time and two it provided an avenue for providers to make toddlers more comfortable with the accelerometers. For this study, classroom providers (both primary and secondary providers) were also asked to wear the accelerometers. It is possible that seeing their providers also wear the accelerometers could have impacted toddlers’ willingness to wear their own accelerometer. Additionally, researchers were present to address concerns providers had with parts of the study and address any challenges providers or children were facing with implementation of the program, including if there were problems wearing accelerometers. Previous preschool research studies in children have found similarly high accelerometer wear time. For example in 2008 Trost and colleagues found that enrolled participants completed 91.5% of possible accelerometer assessments (7). The study by Trost et al. and the TAP study demonstrates that toddlers’ have the ability to wear accelerometers and it was not a problem throughout the study duration.

**Intervention Dosage**
The secondary aim of this study was to examine the implementation outcome variables of the study (intervention dosage and intensity, fidelity, quality, and acceptability). For this study, our dosage aim was an attempt to investigate the actual amount of intervention that was delivered to the toddlers. This is an important first step in understanding what challenges were posed to researchers in delivering the intervention. For instance, toddlers due to their finicky nature (i.e., easily distracted) could easily become disinterested in the intervention and thereby impact the intended intervention dosage of 10 minutes. In addition, when toddlers did not understand the activities, more time was needed in the classroom to re-explain the intervention activities to toddlers. Therefore, it was important to assess the average dosage of the intervention sessions that was delivered to toddlers so future studies can plan accordingly. Study intervention dosage was assessed from daily intervention start and stop time record obtained by research staff. Overall, both the researcher and the provider led intervention sessions met the 10-minute intervention dosage design. The SPACE study, which was a PA study in preschool children aimed at implementing 30-minute outdoor play sessions found that of the outdoor sessions offered 87% met the 30-minute criteria (60). Similarly, a 2016 study from PPAL implemented a 30-minute intervention with some school implementing structured playtime and some schools implementing unstructured playtime (52). During the intervention researchers found that only 56.6% of structured play and 75.2% of the unstructured play time met the 30-minute design (52). Although it seems that 30-minute interventions may be too long, our 10-minute study design seemed to hold toddlers’ attention and remain short enough to implement following morning circle time with minimal interruption. Previous 10-minute physical activity intervention studies
implemented by our lab in preschoolers reported similar findings (61). In the 12-week study implemented by providers, process evaluation data showed that the intervention activities were easily implemented and led to a 2 minute increase in MVPA and 3 minute decrease of sedentary time for preschool aged children (61).

**Intervention Intensity**

The TAP intervention was designed to be moderate to vigorous in intensity. Therefore, we were interested in assessing the intensity of the intervention sessions. This was accomplished by having toddlers wear accelerometers on one randomly selected day per week during the intervention session for the entire study duration. Based on the accelerometer assessment, the intensity of the implemented intervention was sedentary. Overall, the TAP intervention centers spent more time in SED activity compared to the CON center during weekly accelerometer assessments. One potential reason for this was the timing of observations. While the intervention intensity assessment took place during the 10-minute TAP intervention activities, the timing of the control center assessment varied during the study. Often observation of the control center occurred during outdoor play time, which tends to be more active nature (29). Another potential explanation was intervention activities were often made simpler for toddlers to understand and follow. The types of modifications that were completed (e.g., reducing the running space for “fishy fishy”) could have partially reduce the intensity of intervention session.

The intensity of some of the activities utilized in the intervention could have been reported as less intense due to the positioning of the accelerometer (e.g., hip instead of wrist). Many of the activities utilized in the intervention consisted of upper body
movements (such as imitating animals like birds by flapping wings). Therefore, it is possible that hip placed accelerometers would not be able to pick up this type of upper body movement and in turn could explain the lower-than-expected intervention intensity. Although accelerometers are the preferred tool for objectively assessing PA in young children, previous research has indicated that hip placement for toddler age children is more feasible than wrist placement (62). A potential assessment tool that researchers have suggested to overcome this limitation is directly observed PA. Direct observation allows researchers to visually observe and classify toddlers PA using a prescribed direct observation protocol. Direct observation data of the intervention school was collected at study baseline as well as 10-week post intervention. At baseline direct observation of PA and accelerometer measurements provided similar results. Interestingly, our follow up direct observation assessment at 10-weeks revealed a discrepancy between direct observation and accelerometry. Compared to accelerometer data, directly observed PA data showed that toddlers spent more time in LPA to MVPA. The STEP study from our PPAL also saw a similar difference between directly observed (OSRAC-P) and accelerometer assessment of PA (52). This discrepancy could be because many of our activities used upper body movements which were not captured by accelerometers but were captured by direct observation. Future studies should examine this difference as this could play an important role in quantifying the effects of PA interventions in toddlers.

Intervention Fidelity

Intervention fidelity is the extent to which interventionists and providers were able to implement the intervention as planned and modifications made to the intervention.
For the TAP study, only 37.3% of researcher led interventions were implemented as designed, as compared to 56% of provider led interventions. The difference between researcher led fidelity and provider fidelity was noticeable. All the modifications that were done were undertaken to improve the implementation of the intervention. Although this is made the intervention easier to implement within the constraints of the classroom this potentially led to lower researcher led fidelity. It is worth noting that another reason provider led fidelity was higher was due to the fact that researchers implemented the intervention first and modified lessons as needed. Therefore, providers were not assessed based on intervention original design but were assessed basis of the modified intervention.

All lessons were implemented at least once throughout the study with the exception of the game “fishy fishy cross my ocean” which was not implemented due to lack of space. Out of a total provider led sessions (n = 20) there were 11 times when activities (such as fishy fishy) were not implemented. Providers implemented all planned components (warm up, main intervention activities, and cool-down) of the intervention 58% of the time. For researcher led intervention sessions (n = 60), eight planned activities were excluded from the lesson plans. Researchers implemented all planned components 64.7% of the time. In 2014, our lab found that preschool providers implemented intervention activities as instructed 67.2% of the time (36). One reason noted by researchers for why providers implanted all planned components less often than researchers (64.7% vs 58%) could have been time constraints placed on providers who had less time practicing implementing the intervention than researchers. Previous research in preschool providers have corroborated that often providers have more
difficulty delivering PA interventions than other “fact based” lessons such as nutrition (63). This could be due to the fact that providers have more experience delivering typical lessons such as teaching children “fact based” lessons such as nutrition and less hands-on experience delivering movement-based activities such as PA lesson plans.

**Intervention Quality**

Intervention quality was assessed to examine if interventionists and providers implemented intervention activities clearly (i.e., directions were understandable to toddlers and followed the previously agreed upon lesson plan). Data collectors reported that interventionists delivered the intervention clearly 76.7% of the time (Did the intervention leader implement the intervention clearly? Yes= 76.7%; No= 0%; Missing= 23.3%). We believe that this was mainly due to the weekly intervention training that intervention leaders from PPAL received. Providers implemented the session clearly (i.e., directions were understandable to toddlers) at a high rate as well (Did the teacher implement the session clearly? Yes= 62%; No= 8%; Missing= 30%). One potential reason provider quality was lower than interventionists was due to the fact that providers received less training. The providers’ lower training and self-efficacy in delivering interventions could have led to observed lower quality of intervention implementation. Additionally, researchers had far more experience implementing PA interventions in the childcare setting.

**Intervention Adaptations**
Adaptation made to the intervention activities were collected in order to best understand how researchers could improve the future implementation of the intervention activities. This data allowed researchers to assess modifications of the program and why those modifications were made. Common modifications included: guiding toddlers by holding their hands, adding music to activities that did not include music and allowing researchers to implement the activity during days when providers were supposed to implement the intervention due to provider time constraints. These simple adaptations often made intervention activities that were hard or less interesting for toddlers easier for research staff and providers to implement. Although these adaptations helped improve intervention implementation, unfortunately this impacted the overall fidelity of the intervention. For example, if researchers led the intervention and not providers on Thursday this could be one of the reasons the intervention was listed as not being implemented as designed.

Intervention Acceptability

Acceptability was defined for the TAP study as enjoyment and satisfaction of the intervention by providers and toddlers. Overall, provider acceptability of the intervention was high. Post intervention survey data indicates the intervention was well received by providers. This is a reminder of the importance of creating positive environments for providers and toddlers to learn PA skills and grow their self-efficacy. Several providers remarked during post intervention data collection that they would continue to use the activities provided. Providers also commented that they enjoyed having the researchers in the classroom. This intervention created a positive relationship between the researcher
team and providers, allowing future research into toddler PA to continue. Previous research by the PPAL lab in preschool age children has also revealed high acceptability of PA interventions during the childcare day (64). Data analysis of semi-structured questionnaires used in the TAP study reveal that the intervention was also well received by the toddler aged population. Toddlers enjoyed the majority of researcher (70.7%) and provider (60%) intervention sessions. Minimal interruption was needed during the course of the intervention to address toddler behavioral issues. Additionally, one important provider concern (toddler would be scared of researchers due to fear of strangers) was not observed during course of the intervention. Overall, the toddlers seemed to enjoy the activities and wearing the accelerometers.

**Strengths and limitations**

In terms of our study design, there were several strengths that should be noted. First the train the trainer model was successful at teaching providers the weekly intervention activities and how to best implement them with minimal training necessary prior to the start of the intervention. The second strength of the study was that the design of intervention activities heavily incorporated the perspective of childcare providers. Prior to the designing and implementing the TAP intervention, researchers met with childcare providers and conducted a focus group meeting with providers from all participating centers to help researchers determine the components and potential barriers and facilitators of implementing PA in intervention in toddlers (65). The suggestions given by providers were used to design the TAP intervention, for example commentary from providers about the childcare environment such as lack of available PA space within
classrooms helped shape the incorporation of activities that required less space into the intervention. Third strength of the study was the use of accelerometers and direct observation to objectively assess toddlers’ PA. To the best of our knowledge this is the first study to utilize both accelerometers and direct observation to assess toddlers’ activity levels involved in a PA intervention. The ability to modify the intervention when activities were not working was also a strength of the intervention. Interventionists and providers were allowed to make adjustments to the intervention activities to improve the overall implementation of the intervention activities and data was collected on the modifications made. Finally, while we recognize that a short 10-minute intervention does not represent a dramatic change to the physical activity environment. Childcare providers had asked researchers to create a short intervention to be used after circle time. Additionally, by giving childcare providers a short intervention that is easy to implement there is a possibility that providers would use this intervention at other points in the day.

Despite the several strengths of this study, there were some limitations. Although the use of accelerometers to objectively assess PA was a strength, it was still a limitation due to the hip placement of the units. It is possible that the placement at the hip could have limited the devices’ ability to accurately assess upper body activities, which made up a larger proportion of the intervention activities. Previous research examining the placement of accelerometers has shown that vertical axis counts with hip accelerometer placement may not adequately distinguish between toddler PA (e.g., walking) and sedentary behaviors (e.g., being carried) (66). Another limitation is the small size of the researcher staff. Although all efforts were made to adequately staff the intervention and control school, the small staff size of the pediatric PA lab resulted in the lack of research
staff being available to collect process evaluation data at the control center. This could have impacted the experience of control schools enrolled in the study and lead to differential engagement at the control school. Further, centers were recruited based on similar classroom environments, this led to a total of three centers being recruited for the study. This small number of centers recruited for the study could be seen as a limitation and future studies should include more centers for data collection. The short duration of the study (10-weeks) is also a limitation of the current study and future studies should examine the effect the feasibility and implementation outcomes of a longer duration study. It is possible that provider acceptability of the intervention or toddler’s ability to wear the accelerometer could be impacted by a longer duration study.

Conclusion

The purpose of this study was to determine the feasibility and implementation of a toddler PA program implemented during the childcare day. Overall, our findings indicate that we were unsuccessful at meeting participant recruitment goals (<80% of toddler population recruited), but successfully at meeting the study retention (>75% retained at week 10), and accelerometer wear goals (>75% wearing accelerometers at each timepoint). In addition, we were unable to meet some aspects of the study implementation goals. For example, intervention integrity was much lower than expected, with far less than 80% of intervention activities being implemented as designed. Additionally, intensity of intervention was lower than our research goal of >50% of intervention time spent in light to vigorous intensity activity (measured by accelerometers). However, it should be noted that direct observation revealed that
toddlers spent approximately 73.33% of the time in light to vigorous PA. Future research should examine this discrepancy, as direct observation may be better suited for assessing toddlers’ PA when participating in PA interventions. Finally, quality was somewhat lower than expected goal (>80% delivered clearly). In terms of successes within our secondary aims, researchers implemented more than 80% of planned activities with each activity being implemented at least once during the 10-week intervention and the overall intervention was acceptable to both the providers and toddlers.

More research of PA in toddlers during the childcare setting is needed to address the crisis of childhood sedentary time. In particular PA programs, which have shown great success in preschool-age children should be modified and examined in their ability to increase toddler PA. Childcare centers provide care to both toddlers and preschool-age children, however, PA interventions mainly focus on preschool-age children and not toddlers. Future studies should examine ways to develop and implement PA interventions that targets both toddlers and preschool-age children. Overall, this study provides preliminary evidence that a provider-led PA intervention can be implemented to toddler within the childcare settings.
APPENDIX A: PARENT CONSENT AND PERMISSION FORM

Consent Form for Participation in a Research Study
University of Massachusetts Amherst

Researcher(s): Sofiya Alhassan, PhD
Study Title: Toddlers Activity Pilot (TAP) Study — Parent

1. WHAT IS THIS FORM?
This form is called a Consent Form. This form will provide you with the information you will need to understand why this study is being done and explain the involvement of you as the parent or guardian and what your child will need to do to participate. We encourage you to take some time to think this over and ask questions now and at any other time. If you decide to participate, you will be asked to sign this form, and you will be given a copy for your records.

2. WHAT ARE SOME OF THE IMPORTANT ASPECTS OF THIS RESEARCH STUDY THAT I SHOULD BE AWARE OF?
For this study, we are hoping to find out if an activity program design to engage toddlers could improve their physical activity levels. The program is 12 weeks long. Three childcare centers are participating in this study, and all activities and measurements will take place at the childcare center. Prior to the start of the study, two centers will be randomly assigned (like flipping a coin) to participate in the physical activity program (TAP), and one center will be randomly assigned to the health tracking program. If your child is in the center that will participate in the physical activity program in Fall 2019, he or she will participate in 10 minutes of physically active lessons 4 days per week for 10 weeks. All children in your child’s classroom will participate in the physical activity program as part of their normal classroom activities. However, we are individually recruiting children to participate in the measurement portion of the study. If your child attends the health-tracking center, they will continue to participate in their usual classroom curriculum. In Spring 2020, the physical activity program will be offered to their center, and they will be able to participate in the physical active lessons at that time. As the parent/guardian, you will be asked to complete some questionnaires at the beginning and at the end of the study. By participating in the assessment portion of the study, you will help us to understand if integrating physical activity into early learning standards can have an impact on the health of toddlers. The only alternative to being a part of this study is not to participate.

3. WHY ARE WE DOING THIS RESEARCH STUDY?
You and your child are invited to participate in a study designed to examine the feasibility, acceptability, and efficacy of a classroom physical activity program offered during the childcare center day on the physical activity levels of toddlers. We hope to learn if a physical activity program can be successfully implemented during the childcare day and if it will be well received by toddlers and their classroom teachers.

4. WHO CAN PARTICIPATE IN THIS RESEARCH STUDY?
For your child to participate in the assessment portion of this study, he or she must be enrolled in a toddler classroom at either Children’s House, Scantic Valley YMCA Learning Center, or UMass Center for Early Education, and willing to comply with the study conditions included in the project procedures described below. To participate in the parent/guardian portion of this study, you must be the parent or guardian of a toddler student who is eligible to participate in the assessment portion of this study. Although all children in your child’s classroom will participate in the physical activity program, only children whose parents have completed this form are eligible to participate in the measurement portion of this study.

IRB OFFICE USE ONLY

University of Massachusetts Amherst IRB
Protocol #: 2018-974
IRB Signature: [Signature]
5. WHERE WILL THIS RESEARCH STUDY TAKE PLACE AND HOW MANY PEOPLE WILL PARTICIPATE?

The study will take place at the childcare center where your child attends (during their regularly scheduled childcare day) and will last for 12 weeks. All toddlers in your child’s classroom will participate in the physical activity program. However, only children whose parents have completed this consent and permission form are eligible to participate in the measurement portion of this study.

6. WHAT WILL I BE ASKED TO DO AND HOW MUCH TIME WILL IT TAKE?

If you agree to take part in this study and give permission for your child to participate in this study, below is what you and your child will be asked to do.

What you as the parent/guardian will be asked to do and the time it will take

If you decide to participate in the study, you will be asked to complete a brief online questionnaire to provide some basic background information about your child and your family. In addition, you will be asked to complete a questionnaire about your child’s physical activity and screen time behavior at the beginning of the study. At the completion of the study, you will be asked to provide your feedback on what you like or did not like about the study.

The parent/guardian portion of this study will involve the completion of three questionnaires (two at the beginning of the study and one at the end). Each questionnaire will take approximately 5-10 minutes to complete (total of 15-30 minutes). The questionnaires will be available online and can be completed remotely. If you prefer not to complete the questionnaire online, we can provide you a paper copy of the questionnaires for you to complete and return in a sealed envelope.

Please let us know if you prefer to complete the questionnaires online or if you prefer a paper version.

Online  [ ]  Paper copy  [ ]

What your child will be asked to do and the time it will take

If you decide to have your child participate in this study, your child will be asked to complete the following steps. The first thing your child will do is complete baseline measurements in the 2 weeks prior to the start of his or her center’s assigned program. These measures will be conducted during the morning (at his or her childcare center) and will include the following:

1. Physical measures – A research staff member will measure your child’s height and weight. This will take approximately 5 minutes to complete.

2. Physical activity levels – Your child will be asked to wear a small activity monitor on a belt around his or her waist to measure physical activity for 5 consecutive days (Monday – Friday – ONLY at childcare). During this time, research staff will also observe your child’s physical activity level during morning circle time.

Programs:
Dependent on your child’s childcare center, he or she will either participate in the physical activity program or the health tracking program for 10 weeks.

IRB OFFICE USE ONLY

University of Massachusetts Amherst IRIS
Protocol #: 2016-3743
IRIS Signature: [Signature]
1. If your child is in the TAP intervention group, he or she will be asked to participate in a brief physical activity program that is integrated into the Massachusetts Early Learning Standards, which is part of their usual toddler curriculum. This will take place for 10 minutes following morning meeting/circle time Mondays through Thursdays for 10 weeks. Members of our research team and your child’s toddler classroom teachers will lead these sessions. The program will include age-appropriate group-based games and activities. These sessions aim to increase physical activity during the toddler childcare day. All children in the toddler classroom will participate in the daily physical activity program. Only children who have a parent/guardian who has provided consent will participate in the assessment portion of the study. An example of the physical activity intervention activity is “Animal Action,” where researchers will call out different animals and children will be asked to move around the classroom pretending to be that animal.

2. If your child is in the health tracking group, he or she will continue to participate in their usual toddler curriculum for 10 weeks. The center assigned to the health tracking group will receive the TAP program (described above) in the Spring of 2020. No additional information will be collected at this time.

3. Children in both programs will be asked to wear activity monitors for 10 minutes one day per week. During this same time, our research team will directly observe their physical activity levels.

Midpoint measurements:
Halfway through the study (week 5 of the program), your child at both programs will again be asked to wear the activity monitor ONLY during the childcare day for five days. During this time, research staff will also observe your child’s physical activity level during morning circle time.

Post-program measurements:
During the last week of the study, your child will be asked to repeat all of the baseline measurements (both physical measures and physical activity levels using monitors).

Your child’s involvement in this study will last for 12 weeks. The first 2 weeks will be a baseline data collection and will be followed by the 10-week physical activity intervention. Your child will be asked to wear a small activity monitor on his or her waist for 5 days during the beginning, middle, and end of the study. Children will wear this monitor only while they are at childcare. If your child attends the center that receives the physical activity intervention, your child’s participation in the program is expected to last 40 minutes per week (10 minutes during morning circle time, 4 days per week). On one randomly selected day per week, your child will be asked to wear the activity monitor during the 10-minute intervention.

7. WILL BEING IN THIS RESEARCH STUDY HELP ME IN ANY WAY?
There are no anticipated benefits to you as a parent/guardian for your participation in this study. We cannot and do not guarantee or promise that your child will receive any benefits from this study. However, benefits of participating for your child include potentially improved physical activity levels during the childcare day and having fun engaging in the physical activity sessions.

8. WHAT ARE MY RISKS OF BEING IN THIS RESEARCH STUDY?
No risks are expected for parent/guardian participation in this study. The elastic belt used to secure the activity monitor in place may rub on your child’s skin and become uncomfortable. No skin damage should result from this and the discomfort level is minimal.

Your child may be at risk for injury related to physical activity program used in this study. This risk is no greater than the risk your child experiences during usual childcare center play time. The intensity of these
sessions will be no greater than his/her regular school physical activity. A risk of breach of confidentiality always exists, and we have taken steps to minimize this risk as outlined in section 9 below.

9. HOW WILL MY PERSONAL INFORMATION BE PROTECTED?
You and your child’s individual privacy and confidentiality are important to us. We will make every effort to conduct all study procedures in a private area, and only authorized research team members will meet with you and/or your child to discuss this study. The following procedures will be used to protect the confidentiality of you and your child’s study records (informed consent document, physical activity data, questionnaires). The information obtained from this study will be treated as privileged and confidential. You and your child’s right to privacy will be maintained in any ensuing analysis and presentation of the data. You will be assigned a numerical code at the beginning of the study, and all individual data will be identified by the numeric code only. The researchers will keep all study records, including any codes to your data, in a secure location. Only the investigators of the study will have access to the personal data, which will be kept in a folder, locked in a file cabinet in a locked office (Pediatric Physical Activity Laboratory).

Research records will be labeled with a code. A master key that links names and codes will be maintained in a separate and secure location. The master key will be destroyed 3 years after the close of the study. The master key and your personal information will be kept separately on the University secured Box cloud service for 3 years after which they will be destroyed. This list is stored separately from study data on the Box cloud system. Only the investigators of the study will have access to your personal data. In addition, the signed informed consent form will be stored separately from the study data. Signed informed consent documents will be kept in a folder, locked in a file cabinet in a locked office (Pediatric Physical Activity Laboratory). All electronic files containing identifiable information will be password protected. Any computer hosting such files will also have password protection to prevent access by unauthorized users. Only the members of the research staff will have access to the passwords. At the conclusion of this study, the researchers will develop their findings. Information will be presented in summary format, and you will not be identified in any publications or presentations. There could be a possibility of a data breach. However, the research team will make every effort to maintain the confidentiality of all data. There is one exception to confidentiality we need to make you aware of. In certain research studies, it is our ethical responsibility to report situations of child abuse, child neglect, or any life-threatening situation to appropriate authorities. However, we are not seeking this type of information in our study, nor will you be asked questions about these issues. For more information on this policy, visit http://www.umass.edu/research/guidance/mandatory-reporting.

10. WILL MY INFORMATION (PRIVATE INFORMATION) BE USED FOR RESEARCH IN THE FUTURE?
Identifiers might be removed, and the de-identified information may be used for future research without additional informed consent from you.

11. WILL I BE GIVEN ANY MONEY OR OTHER COMPENSATION FOR BEING IN THIS RESEARCH STUDY?
For your time and effort in participating in the measurement portion of this study, your family will receive $5 for completing baseline measurements.

Since you are being compensated for your participation in this study, your personal information may be released to the accounting officials at University of Massachusetts, Amherst. There is no cost to participate in this study.
12. WHO CAN I TALK TO IF I HAVE QUESTIONS?
Take as long as you like before you make a decision. We will be happy to answer any question you have about this study. If you have further questions about this project or if you have a research-related problem, you may contact the researcher(s), (Dr. Sofiya Alhassan at 413-545-3475 or alhassan@kin.umass.edu). If you have any questions concerning your rights as a research subject, you may contact the University of Massachusetts Amherst Human Research Protection Office (HRPO) at (413) 545-3428 or humansubjects@ora.umass.edu.

13. WHAT HAPPENS IF I SAY YES, BUT I CHANGE MY MIND LATER?
You and your child do not have to be in this study if you do not want to. If you agree to be in the study, but later change your mind, you and your child may drop out. If you no longer want to participate in this study or have your child participate in the measurement portion of this study, you have to let us know in writing at least 1 week before the start of each measurement time point. There are no penalties or consequences of any kind if you decide that you do not want to participate. You will be notified of all significant new findings during the course of the study that may affect your willingness to continue.

14. WHAT IF I AM INJURED?
The University of Massachusetts does not have a program for compensating subjects for injury or complications related to human subjects research, but the study personnel will assist you in getting treatment.

15. SUBJECT STATEMENT OF VOLUNTARY CONSENT
When signing this form I am agreeing to voluntarily enter this study. I am also giving permission to have my child participate in the measurement portion of this study. I have had a chance to read this consent form, and it was explained to me in a language which I use. I have had the opportunity to ask questions and have received satisfactory answers. I have been informed that I can withdraw at any time. A copy of this signed Informed Consent Form has been given to me.

Parent/Legal Guardian Name (Print)

Parent/Legal Guardian Signature __________________________ Date ________________

Child’s Name (Print) __________________________

PHOTOGRAPHY, FILM, TAPE, AND INTERVIEW
Children in this study will be photographed while participating in the physical activity intervention. Their pictures will be used only as part of scientific presentations. However, your child can still be part of the study if you do not wish to have him/her photographed. Please let us know which you prefer.

YES    [ ] I give consent to have my child photographed and their photos used in presentations

NO     [ ] I DO NOT wish to have my child photographed

IRB OFFICE USE ONLY

University of Massachusetts Amherst-IRB
Protocol # 2019/5747
PII Signature: [Signatures]
By signing below I indicate that the participant has read and, to the best of my knowledge, understands the details contained in this document and has been given a copy.

<table>
<thead>
<tr>
<th>Signature of Person Obtaining Consent</th>
<th>Print Name:</th>
<th>Date:</th>
</tr>
</thead>
</table>

APPENDIX B: STUDY FLYER

Toddler Activity Pilot (TAP) Study

What we are doing:

- The Pediatric Physical Activity Laboratory at UMass Amherst is studying an activity program on toddler’s physical activity levels

Who we are looking for:

- Toddlers (ages 18 months – 2.8 years) to participate in a 12-week program
- All children will participate in the physical activity program during childcare, but we are recruiting children to participate in the measurement portion of the study

What you and your child will do:

- You will be asked to complete questionnaires about demographic information and your child’s screen time behavior
- At the beginning and end of the study, your child’s height and weight will be measured
- Your child will be asked to wear a small monitor to measure how much they move at the beginning, middle, and end of the program
- Depending on your child’s childcare center, your child will either:
  o Participate in an in-school physical activity program (Fall 2019)
  OR
  o Participate in a health tracking program (this childcare center will participate in the physical activity program in Spring 2020)

Parent/Guardian – Informed Consent/Parent Permission forms will be sent home next week. If you are interested in your child participating in the measurement portion of this study, please complete this form and return to your child’s teacher in the provided sealed envelope. Contact our study staff with any questions by phone (413-545-6104) or email (kinpediah@umass.edu).
APPENDIX C: DEMOGRAPHIC QUESTIONNAIRE (TODDLERS/PARENT)

Toddler Activity Pilot Parent Baseline Survey

Thank you for signing up your child to participate in the assessment portion of the UMass Toddler Activity Pilot (TAP) Study!

The purpose of this survey is to provide us with some basic information about your child and your family. As part of the survey, we would also like to gather information about your child TV and media use behavior. All information that you share with us is confidential. You have the right to skip any question or questions that you feel uncomfortable answering. If you have any questions, please feel free to contact us at the number or email below. You can save your progress and completed information on the form as long as you use the same link and Internet browser to reopen the form. Contact information will be available again at the end of the form.

Contact Information

Sofiya Alhassan
Director, Pediatric Physical Activity Laboratory
University of Massachusetts, Amherst
Department of Kinesiology
Totman Building, Room 110
30 Eastman Lane
Amherst, MA 01003
(413) 545-6104
kinpedlab@umass.edu
Start of Block: Questions About YOUR CHILD

Q1. Child’s first name:

---------------------------------------------------------------------------------

Q2. Child’s last name:

---------------------------------------------------------------------------------

Q3. Child’s school:

---------------------------------------------------------------------------------

Q4. Child’s date of birth:

---------------------------------------------------------------------------------

Q5. Child’s gender:

☐ Male

☐ Female

Q6. To which of the following races do you consider your child to belong? (You may choose all that apply.)

☐ Native American

☐ Asian

☐ Native Hawaiian or Other Pacific Islander

☐ Black or African American

☐ White

☐ Other  ____________________________________________
Q7. Additionally, do you consider your child to belong to any of the following ethnic groups? (You may choose all that apply.)

- [ ] African/African American
- [ ] Asian American
- [ ] Cuban
- [ ] Mexican, Mexican American, or Chicano
- [ ] Middle Eastern
- [ ] Native American Indian
- [ ] Pacific Islander (such as Native Hawaiian, Guamanian, Tongan, Samoan)
- [ ] Puerto Rican
- [ ] South or Central American
- [ ] West Indian or Caribbean
- [ ] Other (please specify) ________________________________

Start of Block: Questions About YOU the Parent/Guardian (Demographic Info)

Q8. Parent/Guardian's first name:

____________________________________________________________________________

Q9. Parent/Guardian's last name:

____________________________________________________________________________

Q10. Email address (if you wish to update this):

____________________________________________________________________________
Q11. Parent primary phone number:

________________________________________________________________________

Q12. What is your current marital status?

☐ Married
☐ Divorced or separated
☐ Widowed
☐ Single - Never Married

Q13. What was the approximate total income, before taxes, of your household for the last year? (Please include wages, salaries, social security, interest, child support, public assistance, unemployment compensation, rent from property and all other income. Only select one response.)

☐ Less than $5,000
☐ $5,000 - $9,999
☐ $10,000 - $19,000
☐ $20,000 - $29,999
☐ $30,000 - $39,999
☐ $40,000 - $49,999
☐ $50,000 - $59,999
☐ $60,000 - $69,999
☐ $70,000 - $79,000
☐ $80,000 - $89,999
☐ $90,000 - $99,000
☐ Over $100,000
Q14. What is the highest level of education that you have completed? (select only one response)

- 6th grade or less
- 8th grade or less
- Attended some high school
- High school graduate or GED
- Technical school
- Some college
- College graduate
- Post graduate degree

Q15. Not including you, what is the highest education level among all the people living in your child's home? (select only one response)

- 6th grade or less
- 8th grade or less
- Attended some high school
- High school graduate or GED
- Technical school
- Some college
- College graduate
- Post graduate degree (8)

Q16. Does your family own the home in which your child lives?

- Yes
- No
Q17. What is YOUR current weight (lbs)?


Q18. What is YOUR current height (inches)?


APPENDIX D: SEDENTARY BEHAVIOR SURVEY

SEDENTARY BEHAVIOR

We would like to learn about your child’s weekday (morning and evening) and weekend day (morning and evening) sedentary behavior at home. The following questions are the exact same questions but for different time frames.
Q19. **BEFORE Child care: Yesterday or Last Friday (Weekday)**
Yesterday (or last Friday), how much time did your child spend before child care (from the time he/she woke up until the start of child care)?
<table>
<thead>
<tr>
<th>Activity</th>
<th>None (0)</th>
<th>15 minutes or less (15)</th>
<th>30 minutes (30)</th>
<th>1 hour (60)</th>
<th>2 hours (120)</th>
<th>3 hours (180)</th>
<th>4 hours (240)</th>
<th>5 hours (300)</th>
<th>6 or more hours (360)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watching television (not including videos on Cell-phone, Tablets, DVD, or Blu-ray players)</td>
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<tr>
<td>Watching movies or videos on a cell-phone, Tablets, DVD, or Blu-Ray Player or iPad</td>
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<tr>
<td>Playing games on a Tablet (like an iPad or Kindle, not including games on a computer)</td>
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<tr>
<td>Playing games on a computer</td>
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<tr>
<td>Looking at a book</td>
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<td>Listening to music (CDs, iPod, or other personal device)</td>
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<tr>
<td>Doing artwork or crafts (like drawing, painting, or making things)</td>
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<tr>
<td>Playing quiet games indoors (like playing with toys, puzzles, or board games)</td>
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<tr>
<td>Playing outside</td>
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<td></td>
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</tbody>
</table>
Q20. AFTER Child Care: Yesterday or Last Friday (Weekday)
Yesterday (or last Friday), how much time did your child spend after child care (from the time school ended until he/she went to sleep)?
<table>
<thead>
<tr>
<th>Activity Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (0)</td>
</tr>
<tr>
<td>15 minutes or less (15)</td>
</tr>
<tr>
<td>30 minutes (30)</td>
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<tr>
<td>1 hour (60)</td>
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<td>2 hours (120)</td>
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<tr>
<td>3 hours (180)</td>
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<tr>
<td>4 hours (240)</td>
</tr>
<tr>
<td>5 hours (300)</td>
</tr>
<tr>
<td>6 or more hours (360)</td>
</tr>
</tbody>
</table>

1. Watching television (not including videos on Cell-phone, Tablets, DVD, or Blu-ray players)

2. Watching movies or videos on a cell-phone, Tablets, DVD, or Blu-Ray Player or iPad

3. Playing games on a Tablet (like an iPad or Kindle, not including games on a computer)

4. Playing games on a computer

5. Looking at a book

6. Listening to music (CDs, iPod, or other personal device)

7. Doing artwork or crafts (like drawing, painting, or making things)

8. Playing quiet games indoors (like playing with toys, puzzles, or board games)

9. Playing outside
Q21. Last Saturday: MORNING (Weekend day)
Last Saturday, how much time did your child spend in the morning (from time he/she woke up until NOON)?
<table>
<thead>
<tr>
<th>Activity</th>
<th>None</th>
<th>15 minutes or less (15)</th>
<th>30 minutes (30)</th>
<th>1 hour (60)</th>
<th>2 hours (120)</th>
<th>3 hours (180)</th>
<th>4 hours (240)</th>
<th>5 hours (300)</th>
<th>6 or more hours (360)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watching television (not including videos on Cell-phone, Tablets, DVD, or Blu-ray players)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Watching movies or videos on a cell-phone, Tablets, DVD, or Blu-Ray Player or iPad</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Playing games on a Tablet (like an iPad or Kindle, not including games on a computer)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Playing games on a computer</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Looking at a book</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Listening to music (CDs, iPod, or other personal device)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Doing artwork or crafts (like drawing, painting, or making things)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Playing quiet games indoors (like playing with toys, puzzles, or board games)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Playing outside</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
22. Last Saturday: AFTERNOON (Weekend day)
Last Saturday, how much time did your child spend in the afternoon (from NOON until he/she went to sleep)?
<table>
<thead>
<tr>
<th>Activity</th>
<th>None (0)</th>
<th>15 minutes or less (15)</th>
<th>30 minutes (30)</th>
<th>1 hour (60)</th>
<th>2 hours (120)</th>
<th>3 hours (180)</th>
<th>4 hours (240)</th>
<th>5 hours (300)</th>
<th>6 or more hours (360)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Watching television (not including videos on Cell-phone, Tablets, DVD, or Blu-ray players)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Watching movies or videos on a cell-phone, Tablets, DVD, or Blu-Ray Player or iPad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Playing games on a Tablet (like an iPad or Kindle, not including games on a computer)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Playing games on a computer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Looking at a book</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Listening to music (CDs, iPod, or other personal device)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Doing artwork or crafts (like drawing, painting, or making things)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Playing quiet games indoors (like playing with toys, puzzles, or board games)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Playing outside</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX E: ANTHROPOMETRIC MEASURES

SID: ____________

Toddler Activity Pilot (TAP) Study

PHYSICAL MEASURES

Today’s Date: ____/____/2019

Assessment timepoint: Baseline 10-week

Order of measurements:
- Following protocol, measure first weight, first height
- Repeat same order for 2nd measures.
- 3rd measurement(s) if needed (follow protocol).

NOTE: If toddlers are not able to stand of scale, measure teacher’s weight than ask teacher to hold child while he/she gets weighed.

Data should not be entered unless protocol was followed.
Box used to indicate measurement notes: R=refusal, X=margins notes regarding this measure.

<table>
<thead>
<tr>
<th>Weight (Teacher)</th>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg</td>
<td></td>
<td>kg</td>
<td>kg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight (teacher + child)</th>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg</td>
<td></td>
<td>kg</td>
<td>kg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight (child alone)</th>
<th>FIRST</th>
<th>SECOND</th>
<th>THIRD</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg</td>
<td></td>
<td>kg</td>
<td>kg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measured Height</th>
<th>=FIRST cm</th>
<th>=SECOND cm</th>
<th>=THIRD cm</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Interference (0.0 if none)</th>
<th>=FIRST cm</th>
<th>=SECOND cm</th>
<th>=THIRD cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>(15.8 if used)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Net Height (Measured – interference)</th>
<th>=FIRST cm</th>
<th>=SECOND cm</th>
<th>=THIRD cm</th>
</tr>
</thead>
</table>
APPENDIX F: RESEARCHER-LED PROCESS EVALUATION

Date:_____/_____/2019  Researcher Initials:_____

Toddler Activity Pilot (TAP) Study
Implementation Form _ Researcher Implemented

Center:_________________ Classroom:_________________

Session Title/#:____________________________________

Intervention Week:_________ Day of the Week: M  T  W  Th

Intervention start time:__:_ ___ am

Intervention end time:__:_ ___ am

1. How many children were present during intervention time? _______

2. Among those with consent/assent, record participants that are in attendance (see attached sheet). Number of participants in attendance: _______

3. How many students participated in the intervention session? _______

4. Approximately how many minutes did the majority of the students participate in? _______

<table>
<thead>
<tr>
<th>Question:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Did at least 50% of the students participate? If no, why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Did the majority of students (i.e. &gt;50%) participate in at least half of the intervention session?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Did the majority of the students (i.e. &gt;50%) seem to enjoy the intervention session (e.g. smiling, actively engaged, having fun)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Did the intervention session appear to hold the interest/attention of the majority of the students (i.e. &gt;50%) participating? If not, explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Did the classroom teacher(s) participate in lesson facilitation?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Did the classroom teacher(s) seem to enjoy participating in the lesson?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>---</td>
<td>-----</td>
<td>----</td>
</tr>
<tr>
<td>11. Did the intervention leader(s) provide encouragement (e.g. great job, nice jump, good listening) during the intervention session? Check off the boxes to denote the number of times positive encouragement was provided.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Was the intervention session implemented as intended? If no, why not?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Did the intervention leader implement the intervention session clearly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Did the intervention leader implement the intervention session correctly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Did the intervention leader implement all of the planned session components? If no, which components were not implemented and why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Were modifications/adaptations made from the original intervention session plan? If yes, what modifications were made?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Did the intervention leaders recommend modifications or changes for the future? If yes, explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Did this observation session go as expected? If no, please use this space to indicate why.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX G: PROVIDER-LED PROCESS EVALUATION

Date: ___ / ___ / 2019
Researcher Initials: ________

Toddler Activity Pilot (TAP) Study
Implementation Form _ Classroom Teacher Implemented

Center: __________________ Classroom: __________________

Session Title/#: ____________________________

Intervention Week: __________ Day of the Week: M T W Th

Intervention start time: _____ : _____ am

Intervention end time: _____ : _____ am

1. How many children were present during intervention time? _______

2. Among those with consent/assent, record participants that are in attendance (see attached sheet). Number of participants in attendance: _______

3. How many students participated in the intervention session? _______

4. Approximately how many minutes did the majority of the students participate in? _______

<table>
<thead>
<tr>
<th>Question:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Did at least 50% of the students participate? If no, why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Did the majority of students (i.e. &gt;50%) participate in at least half of the intervention session?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Did the majority of the students (i.e. &gt;50%) seem to enjoy the intervention session (e.g. smiling, actively engaged, having fun)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Did the intervention session appear to hold the interest/attention of the majority of the students (i.e. &gt;50%) participating? If not, explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Did both classroom teacher(s) participate in lesson facilitation? If not, which teacher implemented the intervention, primary or secondary?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Did the intervention leader(s) provide encouragement (e.g. great job, nice jump, good listening) during the intervention session? Check off the boxes to denote the number of times positive encouragement was provided.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>---</td>
<td>-----</td>
<td>----</td>
</tr>
<tr>
<td>12. Was the intervention session implemented as intended? If no, why not?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Did the classroom teacher implement the intervention session clearly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Did the classroom teacher implement the intervention session correctly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Did the classroom teacher implement all of the planned session components? If no, which components were not implemented and why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Were modifications/adaptations made from the original intervention session plan? If yes, what modifications were made?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Did the classroom teacher recommend modifications or changes for the future? If yes, explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Did this observation session go as expected? If no, please use this space to indicate why.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX H: CONTROL SCHOOL PROCESS EVALUATION FORM

Date: ___ / ___ / 2019     Researcher Initials: ____

Toddler Activity Pilot (TAP) Study
CON Monitoring Form

Center: ___________________ Classroom: ___________________

Program Week: _______     Day of the Week: M  T  W  Th

Location of observation: Indoor     Outdoor

Observation start time: ______:____ am

Observation end time: ______:____ am

2a. Select the category of activities that were offered during the observation:

    _____ Unstructured     _____ Structured     _____ Combination

2b. Who led the observed activities? ________________________________

2c. If structured or combination was selected, describe what activities were observed:

   ___________________________________________________________

2d. If structured or combination was selected, approximately what percentage of the students participated in the structured activities?

   ___________________________________________________________

3. Was physical activity incorporated into the observed classroom activities? If yes, describe.

   ___________________________________________________________
4. Select the category of physical activity that describes the majority of the students during the observation.

_____ Sedentary  _____ Light  _____ Moderate-to-Vigorous

*Sedentary examples: sitting or lying down; Light examples: walking, arts & crafts, building blocks (make children breath a little harder but can talk normally; Moderate-to-vigorous examples: running, biking, dancing, jumping (make children sweat, breath harder, speak a few words in between breaths).

5. Are there any other planned PA sessions throughout the day? If so, describe the type of activity, approximate duration and intensity (ask the teacher).

6. Please note any additional observations:
APPENDIX I: POST-INTERVENTION CHILDCARE PROVIDER SURVEY

TAP Teacher Post-Survey

We thank you for your assistance and accommodations with the UMass Toddler Activity Pilot (TAP) Study. Now that the study has concluded, we would appreciate your feedback and thoughts on the overall program.

This survey should only take a few minutes. If you wish to share any additional feedback, or have any questions for the UMass Pediatric Physical Activity Laboratory team, feel free to contact us at kinpedlab@umass.edu.

Q1. Please select the childcare center where you work:

Q2. What is your primary role in the toddler classroom at your center:

- Primary teacher in Toddler Classroom
- Secondary teacher in Toddler Classroom
- Other

Q3. What is your sex?

- Female
- Male
Q4. How long have you been a toddler classroom teacher?

- Less than 2 years
- 2 - 4 years
- 5 - 10 years
- > 10 years

Q5. How long have you been an early education classroom teacher (toddler and preschool)?

- Less than 4 years
- 5 - 9 years
- 10 - 15 years
- > 15 years

Q6. How satisfied were you with each of the following components of the TAP study?

<table>
<thead>
<tr>
<th>Component</th>
<th>Extremely satisfied</th>
<th>Slightly satisfied</th>
<th>Neither satisfied nor dissatisfied</th>
<th>Slightly dissatisfied</th>
<th>Extremely dissatisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>6a. Timing of the intervention sessions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6b. Daily length of the intervention sessions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6c. 10-week duration of the program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6d. Content of the intervention sessions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q7. If you were slightly dissatisfied or extremely dissatisfied with any of the components of the TAP study mentioned in Question #6, how can the research team improve these components?

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

Q8. How satisfied were you with each of the following components of the TAP study?

<table>
<thead>
<tr>
<th>Component</th>
<th>Extremely satisfied</th>
<th>Slightly satisfied</th>
<th>Neither satisfied nor dissatisfied</th>
<th>Slightly dissatisfied</th>
<th>Extremely dissatisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>8a. Music used during intervention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8b. Equipment used during intervention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8c. Communication between the research team and teachers/staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q9. How satisfied were you with the UMass Research Team implementation of the intervention on Mondays and Tuesdays?

<table>
<thead>
<tr>
<th>Session</th>
<th>Extremely satisfied</th>
<th>Slightly satisfied</th>
<th>Neither satisfied nor dissatisfied</th>
<th>Slightly dissatisfied</th>
<th>Extremely dissatisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>9a. Monday intervention session</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9b. Tuesday intervention session</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q10. How comfortable did you feel implementing the intervention session on Thursdays:

<table>
<thead>
<tr>
<th></th>
<th>Extremely comfortable</th>
<th>Slightly comfortable</th>
<th>Neither comfortable nor uncomfortable</th>
<th>Slightly uncomfortable</th>
<th>Extremely uncomfortable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday intervention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>session</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q11. Is there anything that the UMass Research team could do in the future to improve your comfort level in implementing the TAP intervention:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Q12. Overall, how well do you think the TAP study was received by each of the following groups?

<table>
<thead>
<tr>
<th></th>
<th>Extremely well</th>
<th>Moderately well</th>
<th>Slightly well</th>
<th>Not well at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>12a. Other school</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>teachers/staff</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>12b. Students</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>12c. Families</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Q13. How do you think the classroom physical activity sessions impacted your students' classroom behavior?

<table>
<thead>
<tr>
<th></th>
<th>Extremely improved</th>
<th>Slightly improved</th>
<th>No impact</th>
<th>Slightly worse</th>
<th>Extremely worse</th>
</tr>
</thead>
<tbody>
<tr>
<td>13a. Immediately following the physical activity sessions</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>13b. At other times during the toddler school day</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>13c. Over the course of the 10-week intervention</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Q14. Please provide any additional comments about how you think this program impacted classroom behavior.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Q15. Please select one response for each of the following questions.

<table>
<thead>
<tr>
<th></th>
<th>Extremely likely</th>
<th>Somewhat likely</th>
<th>Somewhat unlikely</th>
<th>Extremely unlikely</th>
</tr>
</thead>
<tbody>
<tr>
<td>15a. How likely are you to continue using any of the session plans during morning circle/meeting?</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>15b. How likely are you to continue using any of the session plans during other periods of the toddler school day?</td>
<td>○</td>
<td>○</td>
<td>○</td>
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Please share any specific opinions you have on any of the following components.

Q16. The TAP research team:


Q17. The classroom physical activity intervention sessions:


Q18. The study assessments/measurements:


Q19. UMass research teams’ communication with you:


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Q20. If you witnessed some of the physical activity intervention sessions, what sessions or program components do you think were most effective?

Q21. If you witnessed some of the physical activity intervention sessions, what sessions or program components do you think were NOT effective?

Q22. For the intervention(s) that you witness that were NOT effective, what can the research team do to improve them?
Q23. What can the research team do in the future to improve the implementation of the TAP intervention.

Q24. What can the research team do in the future to engage toddler parents?

Q25. Is there anything else that you want to share with the research team that was not covered on this survey?


60. Driediger M, Vanderloo LM, Burke SM et al. The Implementation and Feasibility of the "Supporting Physical Activity in the Childcare Environment" (SPACE)


