Program Background

The interventions utilized in this program will be parent/child education and discussion groups on physical activity, with children and parents separated into different groups. Interventions for children and parents will be based on their current stage of change as determined by the transtheoretical model. Then, children and their parents will engage in physical activities together and will have options to find things that match their interests.

Multiple studies have investigated the use of education and physical activity in conjunction to target markers of obesity in children, in addition to physical fitness measures. Research has indicated that engaging obese children in structured physical activity can help decrease weight-related outcomes (BMI, abdominal waist circumference, % fat, skin fold thickness, etc.).[1-4] It is important to note that two studies did not find a decrease in BMI category.[3.5] However, one of these studies found that obese children not engaging in physical activity did have an increase in BMI over the study period, suggesting that physical activity may also have a role in preventing increases in BMI.[5] All studies included aerobic physical activity in their interventions, ranging in duration from 60 to 240 minutes per week and in length from 12 weeks to 1 year.[2-5] One study did not include specifications about the length of their exercise intervention, just that more obese children started with a shorter duration.[1] The lowest amount of weekly activity that led to decreases in weight-related measures was 135 minutes per week.[3] The shortest duration that led to decreases in weight-related measures was 6 months.[4] Only one included upper extremity specific exercise, and this was phased out as children became more accustomed to activity and better able to

participate in full body exercise.[1] Two studies also found improvements in performance-related outcomes, such as shuttle run, medicine ball throw, and jump and reach, after completing these exercise interventions.[2,3] Therefore, interventions in this program will focus on aerobic physical activity (ex. dance classes, soccer) totaling at least 135 minutes per week, with children and their families encouraged to be active on their own outside of structured program activities. Additionally, program participation will last at least 6 months.

With respect to educational interventions, three of the selected studies implemented education for children, parents, or teachers as part of their program.[1,4,5] One study had a total of 4 hours of educational counseling provided over the course of 3 months, with counseling tailored to an individual's stage of change as classified by the transtheoretical model.[1] Another study provided 60-90 minutes of conversation per week for 12 months targeted at improving self-esteem related to exercise for obese children, in addition to providing 10 journals with "homework assignments" these children could complete with their families.[4] They also provided two sessions for parents and three sessions for teachers covering health-related topics.[4] In the last study, parents received an informational booklet on health-related topics, in addition to a 2 hour informational session on the same topics.[5] The children in this study received 2 discussion-based group sessions covering health-related topics, a quiz of lifestyle habits/physical activity, and educational games.[5] In all studies weight-related outcomes either improved or did not worsen (while the control group worsened).[1,4,5] Tailoring education to the appropriate stage of change in the transtheoretical model will allow children (with parents receiving education based on the stage of change their child is in)

to receive information that is most well-suited to them in that moment, as this was shown to have benefits in the one study that utilized this approach.[1] For example, children in the precontemplation stage may receive information on why it is important to be physically active, while children in the preparation stage may receive information on tips to incorporate physical activity into their day. Similar to how educational interventions were provided in these studies, this program will separate children and their parents, so that interventions can be tailored more to the age group of the people receiving the intervention and to allow the children to begin to develop friendships through discussion and educational games. By assigning children to a specific group that they always meet with, children will develop a support system in addition to receiving helpful education. This program will go for a length in between the amount of education provided in the other interventions, with discussion groups meeting for 45 minutes weekly for at least 6 months.

The three outcome measures that will be used to assess patient progress with this intervention are BMI, a one-mile run/walk test, and a pictorial version of the physical self-efficacy scale. BMI in children is a very important health-related measure, as obesity in childhood (which is measured by BMI) is correlated with obesity in adulthood.[6] Additionally, a single-unit increase in a child's BMI was found to increase that child's risk for type II diabetes by 24%, and a half-unit increase in a child's BMI z-score was found to increase the risk of metabolic syndrome by 1.55 times.[7,8] Many of the studies discussed above used BMI as an outcome measure, and the majority found that exercise-based interventions were an effective way to decrease a child's BMI.[1,2,4] Therefore, BMI is a very important indicator of health in children, and one that this

program will seek to improve. Additionally, assessing BMI will aid in program evaluation in order to determine if the current program is effective, as research shows that exercise interventions correspond to a decrease in BMI.[1,2,4]

This program will also aim to improve a child's physical fitness; in addition to being an important marker of physical health, physical fitness has shown to be correlated with cognitive development, and decreased physical fitness has been linked to decreased academic achievement in children.[9] With this program's focus on aerobic physical activities, cardiorespiratory fitness is an appropriate outcome to evaluate. Additionally, cardiorespiratory fitness has been linked to a number of health outcomes, such as obesity and cardiovascular disease, further emphasizing its importance to a child's physical health and use as an outcome measure in this population.[9] One systematic review found that a one-mile run/walk was one of the most reliable and valid outcome measures for assessing cardiorespiratory fitness in young children.[9] Additionally, they also found that there is a valid equation that can be used to assess maximal aerobic capacity based on an individual's time on the one-mile run/walk.[9] Another advantage is that it would not require extensive materials, as some other physical fitness measures might (ex. Bruininks-Oseretsky Test of Motor Proficiency-2 or Munich Fitness Test).

The last outcome measure used would be a pictorial version of the physical self-efficacy scale that was specifically designed for use in young children (pictures added to written rating scale to make it easier for younger children to understand).[10] A copy of this outcome measure is included in the Appendix.[10] Self-efficacy is a main construct in the transtheoretical model, and higher levels of self-efficacy are associated with being in

the later stages of the transtheoretical model and the maintenance of behavioral change.[11] Therefore, this measure will help assess an individual's progression through the transtheoretical model (indirectly) and the likelihood of their ability to continue staying active outside of the program. This measure, including the pictorial additions, was found to have strong factorial validity among children as young as 6 years old and therefore is appropriate for inclusion as an outcome measure for this program.[10]

Program Goals

All goals set from the date the child enrolls in the program

1. In 6 months, children will have decreased their BMI by at least one unit in order to help decrease the risk of chronic illness, such as diabetes or metabolic syndrome.
2. In 6 months, children will have improved their one-mile walk/run time by at least 30 seconds in order to demonstrate improved cardiorespiratory fitness and ability to participate in physical activity.
3. In 6 months, children will have improved their score on the physical self-efficacy scale by at least 2 points in order to demonstrate improving independence with maintaining an active lifestyle and progression through the stages of change in the transtheoretical model.
4. In 6 months, children will be able to list at least 5 benefits for being active and 3 strategies for increasing their levels of physical activity throughout the day in order to demonstrate increased knowledge of how to be active.
5. In 6 months, children will report being active for at least 60 minutes a day on at least 4 out of 7 days of the week to demonstrate increased levels of physical activity and progress towards meeting the current recommendations for levels of physical activity in children.

   For children who are already active for 60 minutes per day 3 or more days per week when beginning the program, this goal would be set to two more days per week than their current level (ex. 6 days per week for someone already active 4 days per week).

Program Methods

This program will partner with primary care practices in the area in order to help identify children who may benefit from our program. By explaining our program to them and giving them handouts for their patients, we should to be able to give them confidence that this is a worthwhile program. Additionally, we will accept self-referrals to our program. In order to enroll in the program, we will collect demographic information from children and have their parents sign consent and liability forms. Then we will do an initial assessment to determine BMI (and see if the child is in fact obese). After, we will have them complete the one-mile run/walk and the pictorial version of the physical self-efficacy scale in order to collect baseline data. We will enroll new participants (up to 30 per session) every 6 months and have a 2-week period during which participants can enroll and complete their baseline assessments. We will also provide a description of the stages of change in the transtheoretical model and ask children (with the help of their parents) to identify which stage most accurately describes them.

We will partner with a local recreation facility (ex. YMCA, East Durham Recreation Center) to serve as a home for our program. By doing this, we will also be able to minimize costs related to purchasing gym equipment, as we will be able to use their equipment and will only need to purchase the things they do not have. We will apply for funding from local and national organizations or grants in order to help cover any costs we may incur.

As mentioned in the background, we will want participants to engage in a minimum of 135 minutes of physical activity per week for 6 months as this is the minimum amount of time that has been shown to promote benefits.[3,4] We will offer four

90-minute sessions per week to provide options for families to meet this requirement and give flexibility for any other scheduling conflicts they may have. Coming two times a week, which will be a requirement, will give individuals 180 minutes per week; however, participants will be welcome to come as many times a week as they would like and are able to. We will offer three sessions on weeknights (Monday, Wednesday, Thursday from 6:30-8:00 p.m.) and one session on the weekend (Saturdays from 10:30 a.m. to 12:00 p.m.). Each night, there will be three different aerobic physical activity “zones” for children and their families to choose from. We will have one area with a team sport activity (ex. soccer, volleyball); this will start out with more basics such as explanation of the rules and simple skills (ex. passing) and will progress to playing casual games as program progresses. Another area will have a self-paced activities, such as jump rope and hopscotch, for children who might feel more anxious about playing a team sport. The last area will provide a higher-intensity aerobic exercise, such as a Zumba dance class or running games like tag. This will provide a variety of options for children to select from that should accommodate an array of skill levels and interests. Parents (at least one) will be required to participate in physical activity activities with their child, although any family members, including siblings, will be welcome to join. These sessions will be led by volunteers (at least 2 per “zone”, so 6 per night). Volunteers can be anyone high school age or older, although at least one volunteer in each group must be a legal adult. All volunteers will complete a training session prior to beginning the program to cover program objectives, expected responsibilities, and logistics of the program. This portion of the program will take place in the gyms or possibly outside if the weather is nice.

Additionally, as mentioned above, program participants and their parents will be asked to attend one 45-minute educational session per week for 6 months in accordance with current research.[1,4,5] These sessions will be timed so that they will line up with physical activity sessions each week in order to reduce the number of nights families need to attend the program. The educational sessions will be offered on Wednesdays from 5:45-6:30 and Thursdays from 5:45-6:30 depending on the discussion group individuals are assigned to. The groups for individuals in the precontemplation and contemplation stages will meet on Wednesdays, and the groups for individuals in the preparation, action, and maintenance stages will meet on Thursdays (if there are individuals in all of these phases at the baseline assessment; if there are no individuals in action or maintenance, then these will not meet). Parents and children will meet in different groups (parent assignment will be based on their child's stage of change) in order to help foster the development of social support groups and ensure tailoring of content to the appropriate developmental level. Each group will be led by one volunteer with some type of health care background (ex. nurse, physical therapist, public health worker). This will require 4 volunteers on Wednesday nights and 6 volunteers on Thursday nights if every group is needed (ex. child precontemplation group, parent precontemplation group, child contemplation group, etc.). Topics covered during the sessions will be based on recommendations from the transtheoretical model and examples are provided in the following chart[5,11,12]:

Stage of Change	**Examples of Interventions**
Precontemplation	Relationship building/getting to know you, raising awareness/providing education on the health risks of being

	inactive, beginning the process of self-evaluation and current health behaviors
Contemplation	Getting to know you, discussion related to current physical activity levels, highlight any prior success with physical therapy, begin consideration of what a more active lifestyle would look like
Preparation	Discussion of barriers to exercise and strategies to overcoming these barriers, discussion of previous attempts to be active and what can be replicated, work to identify an "accountability buddy" in the group
Action	Creation and signing of a group pledge to be more active, identification of specific strategies to be more active at home, check-ins with an accountability buddy, reflection of what has gone well and what hasn't
Maintenance	Reflection on what has changed since becoming more active, discussion with accountability buddy, discussion related to things that have made them want to return to previous levels of inactivity

Educational sessions will take place in a multipurpose room within the recreation center. These sessions will consist of approximately 15-20 minutes of education regarding the night's scheduled topic and then 25-30 minutes of discussion or games incorporating the educational content. Funding may be required in order to print out monthly newsletters that will be provided to children and their parents summarizing the educational content covered over that month.

The main people involved to make this program successful will be the program participants, their families, and program volunteers. The volunteer requirements are

outlined below, and all volunteers would only be required to commit to one shift per week (although they could do more if desired):

	Number of Volunteers Needed
Monday	6 (all to lead physical activity intervention sessions)
Wednesday	10 (6 to lead physical activity intervention sessions and 4 to lead education sessions/discussion groups)
Thursday	12 (6 to lead physical activity intervention sessions and 6 to lead education sessions/discussion groups)
Saturday	6 (all to lead physical activity intervention sessions)
Total	34 (if each volunteer only completes one shift)

6 months after beginning the program, a reassessment will take place for all participants. A participant's BMI, one-mile run/walk time, and physical self-efficacy scale scores will be collected again in order to assess patient progress and if they have met the goals of the program. We will also assess which stage of change the individuals feel most accurately describes them. For individuals who are making progress (or have maybe met the goals but would benefit from continued intervention) and wish to continue in the program, they will be allowed to re-enroll in the program for the next session if there is space after allowing new participants to enroll. If the program fills, they will be asked to continue what they have learned in the program at home and enroll again in the next session (beginning 6 months later) in order to allow more people to benefit from the program. Any participants re-enrolling would be assigned to a new discussion group if they have progressed to a new stage of change as measured by the transtheoretical model.

Program Evaluation

Engage Stakeholders[13]

This program will engage all three levels of stakeholders (program operations staff, those served by the program, and those who will use the findings from the program) in order to complete a successful program evaluation.[13] Those involved in program operations will be the coordinators of the program and all the volunteers who help run the program on a weekly basis. The program participants and their families are the individuals served by the program. Any of our funding partners will be those that will likely seek to use the findings from the program.

Describe the Program[13]

All individuals in these groups will be invited to participate in the program evaluation if they would like and will be provided this program description, including this logic model developed from the CDC's framework for program evaluation[13]:

Inputs	**Activities**	**Outputs**	**Short-term Outcomes**	**Long-term Outcomes**
Educational handouts and lectures, physical activity equipment	Physical activity sessions and education/discussion group meetings	Number of sessions held and attended by participants	Decreased BMI, increased cardiorespiratory fitness, improved self-efficacy	Improved ability to maintain an active lifestyle

Focus the Evaluation Design[13]

At both the midterm point (3 months in) and the conclusion of the program, stakeholders in all 3 levels will be invited to participate in the program evaluation (evaluation design). Program volunteers will be invited to participate in focus groups

(based on if they volunteer with the physical activity sessions or educational sessions) to have a group discussion led by the program director where individuals can share both positive and constructive feedback based on what they have seen in the program.[13] Focused questions will be used to guide the discussion where needed (ex. do you feel that recreation center space and equipment are being used effectively? Are children engaging in discussion during the educational sessions?). Additionally, at the conclusion of the program, data will be presented regarding changes in outcomes from beginning to end of the program to help guide the evaluation of program effectiveness. Program volunteers will also be given a questionnaire where they can provide any anonymous feedback they may not wish to share in a focus group; this questionnaire will have similarly guided questions to the focus groups but also have an area for any open-ended feedback that individuals wish to provide and suggestions for change.[13]

Program participants and their families will also be given questionnaires to fill out at the halfway point of the program and the conclusion of the program. They will be provided with their specific outcome information as well before completing the final evaluation. We will ask them questions related to the feasibility and acceptability of the program (ex. did it seem like a reasonable time commitment?), in addition to questions about their levels of enjoyment of the program. We will also ask if they felt like it was an effective intervention and if they felt like they gained the necessary skills to be able to continue living a physically active lifestyle. Additionally, we will ask for open-ended feedback regarding any suggestions for change for future participants.

Gather Credible Evidence[13]

Funding partners will be invited to come to a presentation where data will be provided regarding the main outcomes from the program (percentage of children who met each of the five goals, in addition to mean changes in scores on the outcome measures). Additionally, we will run data analyses to see if these changes are significant (pre-test post-test design). We will also run analyses to see if there are any differences between children who met goals and children who did not (ex. demographics, program attendance, parent/family participation) in order to help ensure we modify the program where needed to ensure we are serving all participants. After the presentation, funding partners will be able to ask questions about the program and provide any feedback about things they would like to see changed in the future.

Justify Conclusions and Ensure Use of Evaluation Findings/Share Lessons Learned[13]

After all of this feedback has been collected, the program director will compile all feedback and look through suggested changes in addition to overall program success in order to determine how to improve the program for the next session.[13] Any proposed changes will also be discussed with volunteers and funding partners in focus groups in order to ensure agreement. This will help keep the program director accountable to ensure that evaluation findings are used in the future.[13]

Conclusion

Childhood obesity is a growing problem in America, with around 20% of children and adolescents in the United States being classified as overweight or obese.[14] If this problem is not addressed, these children will experience significant health risks, such as increased likelihood of cardiovascular events, cardiovascular damage, increased blood pressure, and type II diabetes.[7,15,16] These children are also more likely to be obese as adults, which confers additional health risks.[8] Clearly, change is urgently needed to address this issue and improve the health and quality of life for these individuals.

This comprehensive childhood obesity program draws on and integrates evidence from previously existing programs that have successfully improved health outcomes in obese children.[1-5] This combination of physical activity sessions and educational sessions/discussion groups will directly increase childrens' levels of activity while showing them new ways to be active in addition to providing them and their families with the information and skills to maintain an active lifestyle outside of the program as well. Additionally, children will be able to develop support groups and identify accountability buddies through their discussion groups, which will help motivate them to stay active.

This program has also developed a strong foundation for program evaluation, with outcome measure selection based on previous research in this population, in order to ensure that the program is effectively working towards improved health in these individuals and that change is made when needed.

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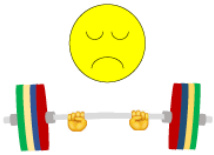
Appendix[10]

Supplemental scales S1:
The physical self-efficacy scale and the physical activity enjoyment scale for children

WHEN I PERFORM PHYSICAL ACTIVITY AT SCHOOL:

	1	2	3	4
1	I run very slowly 	I run slowly 	I run fast 	I run very fast 
2	I am able to do very easy exercises only 	I am able to do easy exercises only 	I am able to do difficult exercises 	I am able to do very difficult exercises 
3	My muscles are very weak 	My muscles are weak 	My muscles are strong 	My muscles are very strong 
4	I feel very tired when I move 	I feel tired when I move 	I don't feel tired when I move 	I don't feel tired at all when I move