

A Proposal for a Community-Based Health Promotion Program for the Treatment of Prevention of Pediatric Obesity and Diabetes

I. Background

Pediatric obesity and type 2 diabetes are rapidly becoming widespread health conditions of near-epidemic proportion. This community-based health promotion program will seek to both prevent and reverse these chronic health conditions utilizing three primary intervention strategies: individualized nutritional counseling, physical activity promotion and sedentary lifestyle disincentivizing, and thorough patient and family behavioral educational interventions.

There is ample evidence to support these interventions for the effective clinical management of childhood obesity and diabetes. The American Medical Association's expert committee recommendations on the management of childhood obesity consist of dietary and physical activity modifications combined with behavioral strategies such as motivational interviewing.¹ The authors recommend a multi-staged approach, beginning with preventative measures and progressing towards structure weight management and multidisciplinary intervention. A 2019 Cochrane review from Brown et al analyzed 153 randomized control trials targeting dietary or physical activity interventions for the management of childhood obesity, and found that on average interventions that combined both physical activity and dietary changes were the most effective across all age ranges.² Furthermore, interventions that targeted diet alone were the least effective. These findings support the need for a comprehensive, multidisciplinary approach to this problem.

Fortunately, numerous trials and pilot studies have attempted to implement similar programs to add to the overall evidence base for this approach. Examples of these trials include the Guelph Family Health Study, a home-based program which emphasized educational health advice delivered to the child's parents, the TODAY Study Group, which experimented with different combinations of pharmacological therapy and dietary educational advice, and the Positively Fit trial, which combined nutrition and physical activity education with behavioral psychology interventions.³⁻⁵ Primary outcomes in most of these trials focused on reduction of body mass index (BMI), a generally reliable measure for tracking weight loss in obese populations, and the trials on average saw favorable and positive results. It should be emphasized again that the trials that focused primarily on educational materials had less notable results; the most effective trials, such as Stark et al's pilot study, combined home- and clinic-based intervention, and implemented methods that tracked actual lifestyle change, such as the use of step tracking devices and food logs.⁶ Evidence supports the use of pedometers and individualized step goals for producing weight loss in obese children,⁷ as well as the use of food logs and nutritional counseling.⁸

Specifics of dietary and nutritional counseling strategies will ultimately be explained in further depth in the Methods section of this paper, and practically, a registered dietician or nutritionist will be employed for this community program. The aforementioned trials all implemented the Traffic Light Diet, an evidence-based nutritional counseling strategy for obese children.⁷ This diet uses the concept of green, yellow, and red light foods to help children make healthy and appropriate food choices. The popularity of this diet plan is likely attributable to its simplicity and ease of

implementation; the combination of parent and child nutritional education using this diet plan with the use of weekly food logs will be an integral aspect of this community health promotion program. Other planned nutritional interventions include training regarding the home food environment and incorporating the entire family in making dietary changes.

With regards to physical activity, the ultimate goal is to encourage increased activity and decreased sedentary activity throughout the day. Simply performing concentrated exercise in the physical therapy clinic is both a poor use of resources and time and will not effectively lead to sustainable weight loss. Previously cited research supports the use of pedometers (wearable step tracking devices) for increasing daily activity; step tracking technology is present on most modern smartphones and fitness wearables, so it is reasonable to expect good adoption of this technology if encouraged. Exercise, both aerobic and resistance based, is well-supported in the literature for the management of both obesity and diabetes.⁹ Experts note that traditional resistance exercises and prolonged continuous bouts of aerobic exercise are typically not tolerated or accepted by the pediatric population; instead, games and sports activities are preferred.⁹ The positive effects of exercise appear to be dose-dependent; in a trial on subjects with diabetes, longer walks were linearly associated with more stable blood sugar levels, most notably in the postprandial time period.¹⁰ Another trial found profound metabolic improvements when breaking up prolonged bouts of sitting with merely 90 seconds of walking.¹¹ Even in the smallest of doses, simply walking more and sitting less has been shown to lead to dramatic improvements in those with obesity and diabetes. A small trial confirmed this on a cohort of obese children between the ages of

6 and 14, implementing a twice-weekly exercise program consisting of hour-long indoor and outdoor activities performing activities that emphasized strength, balance, and endurance in a fun environment, and over the course of 12 months significant improvements in hard outcomes (BMI and VO2 max) were seen.¹² For effective use of resources, time, and emphasis of long-term sustainable improvements, this community program will prioritize activity incentivizing and education, with a decreased emphasis on actual exercise performed in the clinic.

The previously cited American Medical Association recommendations make note of the stages of change theory found in the Transtheoretical Model.¹ As most of the educational, dietary, and activity changes encouraged in this program are dependent on parents and children recognizing a problem and taking the steps to address it, consideration of the patient's willingness and readiness to change is paramount. There are useful, evidence-based algorithms present to help identify parental stages of change, identify influencing factors (such as the child's age or the parent's health beliefs), and to help parents move from towards the preparation and action stages.¹³ Health beliefs of both the child and parent can be addressed directly using the Health Belief Model, and a template for this was recently published by Abdeyazdan et al in 2017. Educational sessions with the mothers of obese children addressed obesity-related topics, including threats, benefits, barriers, and knowledge, and the authors saw improvements in long-term obesity-related behaviors when using the Health Belief Model as compared to a control group.¹⁴ Interpersonal dynamics between the child and parent must be considered in addition to individual aspects of the child in particular.

Multiple outcome measures will be used to track progress. Biometric measures such as body mass index are reliable and valid for diagnosis of obesity; many of the trials previously cited use BMI as the principle outcome measure, as it is easily calculated based off of the patient's height and weight. Self-report measures with sound psychometric properties will be routinely administered to parents and children. The KIDSCREEN-10 (and its longer versions, the 27 and 52 item variations) is a useful measure for health-related quality of life in children,¹⁵ and the 16-item Physical Activity Enjoyment Scale can be used to measure changes in physical activity beliefs and habits.¹⁶ The 36-item Short Form Health Survey (SF-36) is also well-supported for tracking changes in BMI.¹⁷ A more objective measure to track improvements in physical fitness is the ever-popular Six-Minute Walk Test (6MWT), which has been validated in obese children with minimal clinically important differences established to show improvements.¹⁸⁻²⁰ This test can be performed to establish a baseline of physical fitness and track improvements in fitness over time. This combination of outcome measures will provide a comprehensive picture of improvement in the child's health, both subjectively and objectively, will special care taken to track changes in behaviors and beliefs.

I. Program Goals

This program will utilize many of the aforementioned outcome measures in goal setting and progress assessment. The emphasis of this program is on patient and family education, habit setting, and stage of change development—with hard outcomes involving obesity reduction and prevention expected to accompany these changes.

Anticipated goals are as follows:

1. By the end of the three-month program, the child's 6MWT distance will improve by at least 68 meters to demonstrate statistically-significant improvements in aerobic capacity and functional improvements.¹⁸
2. At twelve months follow-up following the conclusion of the program, the child will have maintained between a 0.12 and 0.25 unit decrease in zBMI to demonstrate long-term achievement of healthy and clinically-meaningful reduction in obesity.^{21,22}
3. At twelve months follow-up following the conclusion of the program, the children's health-related quality of life (HRQoL) score (measured by the PedsQL outcome measure) will have improved by at least 4.5 points to reflect a minimal clinically important improvement in HRQoL.^{4,23}
4. By the end of the three-month program, the child will demonstrate an increase of at least 500 steps per day via pedometer to demonstrate significant and consistent improvements in daily non-exercise-related activity.⁷

This combination of SMART goals will seek to measure multiple metrics of progress across both objective and subjective domains and across multiple timelines. These SMART goals were determined through evidence-based outcome data with

available psychometric properties and were based on established minimal clinically important differences (MCID). Additional scales, such as the Physical Activity Enjoyment Scale and a proprietary dietary adherence scale, will be utilized, but due to the lack of established psychometrics, these were not included in the above SMART goals to determine the success of the program.

II. Methods

This program will take place over the course of approximately 3 months, or 12 weeks, with the majority of annual participation intended to take place over the summer months while most schools are not in session. This is an ideal time for children to work on forming new habits, allowing for ample time to make changes without the additional burden of schoolwork or other obligations, and the summer weather will encourage additional outside play time, increased step goals, etc. The summer months also typically allow more freedom for parents or guardians who will be responsible for transporting the child (and themselves) to and from the clinic. Additional program sessions will be planned to overlap with holiday months (e.g., November through January) or at other times throughout the year, assuming adequate admissions and attendance.

The program itself will be centered in a multidisciplinary outpatient clinic setting in Asheville, North Carolina, which employs multiple allied health professionals (including physical, occupational, and speech therapists) in addition to registered dietitians and a pediatric-specialized clinical psychologist. The program will consist of group sessions in the clinic which will include the children and their parents or family, in addition to home visits. These group sessions will be led by the physical therapist, but the topics of focus will vary weekly, with nutrition or psychological concepts occasionally taking the lead.

In brief, the program schedule and interventions will consist of twice-weekly sessions for the first six weeks, followed by once-weekly sessions for the final six weeks. During the first half of the program, sessions will be split between one day in the clinic participating in group education sessions lasting 60 to 90 minutes and one day

participating in home visits lasting 30 to 60 minutes to reinforce the educational materials from earlier in the week. The second half of the program will be reduced to clinic-only sessions, emphasizing maintenance of lifestyle changes, more advanced education, and transition to future goal setting and “graduation.” Plans will be made to follow-up with the child and family approximately 12 months (one year) following graduation from the program to assess long-term goals and outcomes described above.

Intervention specifics will be discussed in detail in the following section. As discussed in the Background section, intervention topics are generally categorizable between 1) physical activity promotion, 2) nutritional and dietary improvements, and 3) psychological counseling focused on habit formation, rewards for change, goal setting, etc. These interventions will be underscored with consideration of both the Health Belief Model as well as the Stages of Change concept found in the Transtheoretical Model. The educational material will be intelligently structured over the course of the twelve-week period to gradually incorporate new health beliefs and advance the child and the parent through stages of change, with the ultimate goal to graduate families comfortably in the preparatory and action stages. Additional consideration will be given to individual and interpersonal dynamics involving the child and his or her family. Home sessions will heavily emphasize family involvement, as previously cited research has found strong relationships between parental health beliefs and childhood obesity outcomes.^{1,13,14} Clinical psychologists with pediatric specialties will participate in separate one-on-one sessions with the child and the parents, in addition to group sessions, to comprehensively evaluate and incorporate family and household dynamics.

Recruitment and admissions criteria will be generally lenient, given the growing obesity epidemic and need for intense and deliberate preventative measures in most communities. Age requirements for the child will be between 6 and 16 years of age, with increased emphasis given towards recruitment of children (approximately 7 – 12 years) over adolescents (approximately 13 – 17 years). The child must be at or above the 95th percentile BMI for their sex and age to satisfy the obesity criteria. Lastly, the child must have a committed parent or guardian figure who is willing to participate in weekly group sessions and is capable of reliably transporting the child and themselves to and from the clinic on a weekly basis, in addition to having a safe and accessible home environment for the initial six weeks of home visits. Additional priority will be placed on those with resources or access to pedometers or related activity-tracking devices, such as most modern smart phones.

Initial intake will consist of baseline outcome measure assessments of the Six-Minute Walk Test, health-related quality of life as measured by the PedsQL assessment, the Physical Activity Enjoyment Scale, and a proprietary dietary habit assessment developed by the on-site dietician. Basic demographic data and biometric data (BMI, height, weight, vital signs, etc.) will be collected during the first session as well. All of these outcome assessments will be reassessed at 6 weeks (halfway), 12 weeks (the conclusion of the program), and again at 12 months follow-up.

The following section will discuss intervention specifics, with the understanding that a precise breakdown of the minutia of 18 hour-long educational sessions is neither practical nor realistic for the scope of this paper. A general overview of the composition and progression of these sessions has been discussed briefly earlier in this section. On

a macro level, clinic sessions will be progressed over the course of 12 weeks from an emphasis on longer group and family-oriented sessions towards shorter, more segmented sessions with the families and children in separate simultaneous sessions. This equally represents a transition from emphasis of interpersonal dynamics towards individual dynamics. Education sessions focused on physical activity promotion and sedentary lifestyle disincentivizing will be led by the physical therapist; education sessions focused on dietary and nutritional changes will be led by the dietician; and education sessions focused on behavioral and habit changes will generally be led by the clinical psychologist. Home sessions will be attended by the healthcare professional whose material was prioritized that week.

Physical therapist-led education sessions will highlight the following concepts: establishing baseline daily steps via pedometer, establishing individualized daily step goal increases, screen time reduction strategies, discussion of increased outside time and play time, individualized physical activity goal setting strategies, and more, in addition to leading the regular 6MWT assessments.^{2,4,6,7,12}

Dietician-led education sessions will highlight the following concepts: general nutrition information, nutrition facts label reading, portion control strategies, the Traffic Light Diet, use of daily and weekly food logs, grocery store shopping strategies, snacking and meal timing strategies, and more.^{2-4,6,8} The dietician will also assess daily and weekly food logs (to be filled out by the participating family members, in addition to the child if age-appropriate) and provide personalized weekly advice.

Clinical psychologist-led sessions will highlight the following concepts, many of which will be integrated into other education sessions or performed simultaneously:

stimulus control, habit formation, goal setting strategies, parental role modeling concepts, stage of change concepts, addressing of health beliefs, eating disorder education (when applicable), social support and bullying education, and more.^{1,4,6,13,14,23,24}

Lastly, home sessions will be led by the lead healthcare professional from that week. Examples include a physical therapist assessing the patient's home and neighborhood environment and offering suggestions for increasing physical activity or reducing sedentary activity, or a dietician assessing the home food environment and grocery shopping habits.

Final evaluation and discharge—appropriately dubbed “graduation” due to the population of relevance—will include reassessment of the previously described outcome measures, short-term SMART goals, in addition to individualized exit interviews with the child and their family to assess health beliefs, stages of change, anticipated changes, arrange for 12-month follow-up, and assess satisfaction with the program.

III. Program Evaluation

Outcomes, both objective (e.g., BMI, 6MWT performance) and subjective (e.g., HRQoL), will be assessed three times during the length of the program (baseline, midway, discharge) and once again at 12-month follow-up. The reasoning behind this assessment timeline is twofold. First, many MCIDs, such as reduction in BMI, are not realistically expected to be achieved in only 12 weeks, certainly not in a healthy manner, whereas others, such as improvement in walking capacity via 6MWT, can be seen in as little as 4 weeks.¹⁹ Second, the treatment of childhood obesity is not an *acute* issue; true assessment of long-term and sustainable lifestyle change cannot be reasonably assessed in the short-term, especially if lifelong prevention and sustained reversal of this disease is to be expected. It is expected, based off of data from pilot trials on similar programs, that anywhere from 15% to 50% of subjects might be lost to follow-up after 12 months for any number of reasons (e.g., communication difficulties, family moving to another area, etc.)^{4,6} While loss of long-term follow-up is an unfortunate (but expected) occurrence, including both short-term and long-term goals allows for the program to evaluate program success through the lens of both *reversal* and *prevention of relapse* of the disease.

In the short-term, loss of bodyweight, reduction of BMI, and improvement of aerobic capacity as measured by the 6MWT are the prioritized objective measures. Research has established a range of MCIDs for clinically-significant reduction of BMI in pediatric populations in the long term^{21,22} but recent trials have established that even moderate reductions in bodyweight (~10%) can lead to improved risk factors in those with obesity and type 2 diabetes.²⁵ Routine assessment of these biometric data will

allow for nuanced assessment of weight loss trends in both the short-term and long-term. As discussed in the Background section earlier in this paper, improvements in the 6MWT distance in obese children has been validated and determined to be responsive and sensitive to change in both the short-term and long-term, with MCIDs established and strong correlations found between improvements in aerobic capacity and ambulation capabilities.¹⁸⁻²⁰

With regards to subjective improvements, many validated self-reported assessments tools will be used to assess changes in health-related quality of life (in both the child and their family members,) health beliefs, enjoyment of physical activity, and other domains related to obesity-related lifestyle habits and attitudes. These include the PedsQL, which was included in a long-term SMART due to its MCID and other psychometric properties,²³ in addition to the KIDSCREEN-52,¹⁵ the Physical Activity Enjoyment Scale,¹⁶ and a proprietary questionnaire designed to assess parental beliefs in the context of the Health Belief Model.^{14,26} Some data suggest strong relationships between parental health beliefs and children's health beliefs, so these will be administered to both family members in addition to the child subjects to gather additional data and track trends over time.^{13,14,23,27}

To reiterate once more, the large variety of outcome assessments utilized in this program is intentional and by design. Obesity and diabetes, as disease conditions, do not appear over 12 weeks, and therefore it is unrealistic for profound physiological changes to be affected over 12 weeks. Objective measures are included over both the short-term and long-term to track hard outcomes and definitive changes. However, emphasis is placed on the variety of subjective measures, which, when combined over

the short-term and long-term in conjunction with thorough clinical psychological intervention and emphasis on multiple behavioral models, should result in long-term sustainable change that will benefit the child and their family over their lifetimes.

IV. Conclusion

The combination of obesity and type 2 diabetes has become a massive health crisis in America and much of the westernized world, resulting in an enormous healthcare burden that continues to rise. Perhaps more alarmingly, the prevalence of “diabesity” in youth between the ages of six and nineteen have recently reached as high as 20% and continue to rise at nearly 7% annually.²⁸⁻³⁰ Preventing and reversing obesity in childhood accomplishes the twofold benefit of ameliorating an already-burdensome health crisis while preventing it from feeding forward into adulthood. This community wellness program proposes an evidence-based reversal-and-prevention strategy founded on three primary intervention strategies: 1) increasing physical activity and decreasing sedentary activity; 2) improving nutritional education and dietary habits; and 3) integrating clinical psychological principles that incorporate family dynamics, motivational- and goal-setting strategies, and multiple behavioral and social models and theories. Utilizing a multidisciplinary healthcare team in individual, group, and home environments, this program will encourage engagement and involvement among the individual, interpersonal, and community levels of the local social ecology. Lastly, by emphasizing both objective physiological improvements and subjective changes in attitude, beliefs, and lifestyle in both the child and the family/parent/child dynamic, this program seeks to make both immediate and long-term sustainable change.

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