A Pilot Study to Assess the Compliance and Impact on Weight of Kurbo, a Pediatric Centered Weight Loss App
Clinical Trials ID NCT02880254
2/25/19

Protocol Title: A Pilot Study to Assess the Compliance and Impact on Weight of Kurbo, a Pediatric Centered Weight Loss App

Principal Investigator: Rushika Conroy MD MS
Research Coordinator: Victoria Cobb
Statistician: Alex Knee, MS

A Pilot Study to Assess the Compliance and Impact on Weight of Kurbo, a Pediatric Centered Weight Loss App
Clinical Trials ID NCT02880254

Background

As a result of childhood obesity and its comorbidities, this generation of children might be the first to not outlive its parents. The national prevalence of adolescent obesity has increased from 5% to 21% over the last five decades (1). Even more discouraging is that youth are being afflicted with the same obesity-related comorbidities that are affecting adults. Conditions such as type 2 diabetes, hypertension, non-alcoholic fatty liver disease, dyslipidemia, metabolic syndrome, and sleep apnea are being diagnosed in children at younger and younger ages.

Lifestyle modification continues to be the cornerstone of treatment for obesity and its associated conditions. The basic concept behind lifestyle modification is a balance of caloric intake and caloric output. Lifestyle modification alone has shown to result in on average 5-10% weight loss over a 6 month period in adults or a 1-2 kg weight loss over 6-12 months (2, 8). In pediatrics, weight loss is generally not used a marker of success given that the child is still growing linearly in most cases. Thus, changes in BMI and/or BMI z-score are utilized to measure success. Pediatric studies cite improvements in BMI z-score ranging from 0.004 to 0.42 with most studies averaging a 0.1-0.2 decrease in BMI z- score over 6 to 12 months (3, 4).

The pediatric weight management program at Baystate Medical Center sees children and adolescents from the ages of 2-20 years. Standard care for the program involves monthly visits with a physician (either a general pediatrician or pediatric endocrinologist) or a nurse practitioner in addition to visits every 3 months with a registered dietitian. During each visit, food and activity recalls are conducted and 1-2 goals are made with the patient and their caregivers that focus on improving the quality and quantity of the patient's intake as well as increasing physical activity. Goals are personalized and are adjusted to meet the social, psychological, financial and motivational needs of the patient.

Sixty four percent of Americans own smartphones (5). The use of smartphone apps for health and wellness has sky rocketed as more sophisticated and user friendly apps are being developed to assist with weight loss, healthy eating, exercise and tracking food and activity. Digital tools can allow one to be constantly aware of how much they are eating and expending, which may result in an improvement in overall weight loss. In adults weight loss of 1-5 kg over a 6 month period is achievable using tools such as food log apps (6, 7). Such apps are generally suited for adults only and the few weight loss apps targeted toward the pediatric population have not been validated by weight loss programs. Apps that are available for younger patients have been criticized for containing inadequate expert recommended strategies for achieving a healthy weight, lack of goal setting, and poor provision of education.

Kurbo is a health and fitness app that is targeted toward the pediatric population. It utilizes games and activities to educate children about healthy eating, portion control/size and exercise. It allows for food tracking by using servings of macronutrients and food groups and sets goals for achieving a healthy BMI through modification of diet intake. In addition to being created solely for children and adolescents, a unique feature of this app is an option to speak with a personal health coach on a regular basis to obtain feedback, advice and encouragement. Studies suggest that weight loss outcomes are best with more frequent contact hours but most weight loss clinics, including ours, are not equipped to meet with

patients on a weekly basis or even monthly basis. The personal coaching aspect of Kurbo is expected to improve outcomes by increasing user access to feedback and advice.

A Pilot Study to Assess the Compliance and Impact on Weight of Kurbo, a Pediatric Centered Weight Loss App
Clinical Trials ID NCT02880254
Specific Aims

The purpose of this pilot study is to assess the feasibility, compliance with and effects of a pediatric centered weight loss app on BMI z-scores in a group of children and adolescents in a pediatric weight management program. We will assess the impact of the app as an adjunct to current weight management therapy, both with and without the personal health coach (PHC) option. We propose the following primary specific aims.

Primary Specific Aims & Hypotheses

1. The **Primary aim** is to assess 3 month compliance with the Kurbo app as well as the Kurbo app and PHC by a group of morbidly obese children and adolescents in a weight management program.
    a. We hypothesize that compliance with the Kurbo app and Kurbo app plus PHC will be better than known compliance of our standard of care group.
2. The **Secondary aim** is to assess the effect of the Kurbo app as well as the Kurbo app and PHC on 3 month change in BMI-z score among morbidly obese children and adolescents undergoing a weight management program.
    b. We hypothesize that the use of the Kurbo app and Kurbo app plus a personal health coach will result in a greater reduction in BMI z-score over 3 months than known change in our standard care group.
    c. We hypothesize that the use of the app and personal health coach will result in a greater reduction in BMI z-score over 3 months than with the use without the personal health coach.

A Pilot Study to Assess the Compliance and Impact on Weight of Kurbo, a Pediatric Centered Weight Loss App
Clinical Trials ID NCT02880254

Methods

Study Design: We wish to establish that Kurbo and/or Kurbo + PHC have better compliance and/or change in BMI-z scores than our current standard of care. To do this we will use two single arm studies, where subjects will be randomized into either group; however, each will be compared to our known standard. Assuming that we can establish better compliance and/or change in BMI-z score, we will also generate descriptive estimates using a parallel randomized trial design comparing the two groups (Kurbo vs. Kurbo + PHC).

Setting: Baystate Children's Hospital is an academic medical institution affiliated with University of Massachusetts School of Medicine. The Baystate Medical Center Pediatric Weight Management program sees patients from the ages of 2 through 20 years for the management of obesity and its comorbidities. Visits take place every 4-6 weeks with a physician, and visits with the dietitian occur about every 3 months. There are currently over 600 patients in the weight management program, with more than half in the pre-adolescent and adolescent age groups. The clinic is composed of two physicians (one general pediatrician and one pediatric endocrinologist), a nurse practitioner and three dieticians. Visits are conducted at the outpatient pediatric subspecialty center in Springfield, Massachusetts.

Inclusion Criteria: Subjects will be screened in and approached based on the following criteria:

1. At least 10 years and no more than 17 years of age
2. New patients presenting to the Baystate Children's Hospital pediatric weight management program

Exclusion Criteria: Subjects will be excluded if any of the following conditions are met.

1. Do not own or have regular access to a smartphone
2. Cannot read and understand English language as Kurbo is currently only designed for English speakers

Screening: On average, about 22 new patients are seen in our weight management clinic each week. Identification of potential study subjects will be conducted by the Pediatric Endocrinology research coordinator by reviewing the clinic schedule available on Centricity. In order to avoid competition with an existing study, we will begin our screening process at their second appointment in the weight management program (approximately 4-6 weeks following their first visit). In order to track our recruitment rates, we will maintain a list of all screened in patients in our REDCap database. Subjects meeting initial inclusion criteria will be approached during their clinic visit in order to assess additional eligibility criteria (smartphone access, ability to read and understand English). These discussions will be held in a private examination room with the patient and a family member or legal guardian. Following confirmation of eligibility, the research coordinator will begin the consent process.

Consent Process: Interested and eligible patients will be consented by the Pediatric Endocrinology research coordinator in a private examination room. The consent will be reviewed with the patient and caregiver and up to 48 hours will be given for the patient to consider agreeing to participate in the study. Questions will be answered at the time of review of the consent and can be asked for up to 48 hours as well.

Baseline Assessment: Following the consent process, subjects will be assisted with downloading the Kurbo app to their smartphones and will be instructed to go through the brief tutorial on use of the app by the research coordinator. Additional baseline data will be abstracted from the medical records based on their first standard of care visit. For example, all subjects are weighed and measured to the nearest 0.1 kg and 0.1 cm, with a standard seated digital scale and calibrated stadiometer, respectively. BMI is calculated as weight in kilograms divided by height in meters squared. BMI z-score is determined by the standard deviation of the BMI from the mean.

Randomization, Allocation and Blinding: A random permuted stratified block randomization scheme will be generated by the Baystate Epidemiology/Biostatistics Research Core (EBRC) and imported into REDCap. Stratification will include two levels: patients aged 10-14 and 15-17 years old. We wish to stratify as the younger group may have more parental oversight and assistance with managing Kurbo, as well as answering survey questions. The REDCap module will conduct the allocation based on the randomization scheme. During the baseline assessment, subjects will be randomized by the research coordinator to Kurbo or Kurbo + PHC using the Tufts REDCap randomization module. The research coordinator will click on the randomization button and alert the subject to which group they have been assigned. Discount codes will be provided to the RC to use when purchasing the Kurbo PHC. In order to register for Kurbo, subjects will need to provide a first and last name, date of birth, phone number and email address. For subjects under the age of 12 years, a parent or caregiver must attest that they are allowing his/her child to sign up for Kurbo during the registration process. For further details regarding Kurbo's HIPAA and security rights, please see attached letter from Kurbo. Clearly, we will not be able to blind the subject or the research coordinator, however attempts will be made to blind the study PI. Although the PI will have access to REDCap in terms of recruitment and baseline information, their read access will be restricted by the EBRC so that she is blinded to randomization and allocation. The research coordinator will instruct the subjects to not discuss their group assignment with the PI. In addition, subjects will be instructed to not purchase the PHC during the study window. Although the PI will be blinded to all surveys and group status, but will be aware of weights throughout the study as this is part of standard of care. The research coordinator will have access to all of this data as their main role is to implement the protocol and ensure complete and accurate data collection. However, in order to minimize their influence and awareness of subject responses for surveys we will implement the following procedure: During a scheduled visit, the research coordinator will open up a survey link for the patient on a Baystate PC and then will leave the exam room giving subjects privacy while answering survey questions. Subjects will be instructed to submit the survey using the button at the bottom of the survey and request for the research coordinator to return. Although not formally blinded, the research coordinator will be instructed to not view the survey responses (they will only see if they are complete/incomplete or partially complete) or have conversations with subjects in regards to compliance.

Follow-Up: As part of standard of care, subjects will be seen every 4-6 weeks during their regularly scheduled weight management appointments to assess height, weight, and to calculate BMI. The subject will meet with a dietitian for further guidance and recommendations at baseline and the end of the study (approx. 3 months) and will meet with the physician for a routine exam at each visit as per standard of care in our pediatric weight management program. In addition to standard of care, at each visit subjects will complete the questionnaire as described above. Branching logic will be used within REDCap to direct appropriate questions to subjects with or without the PHC. The questionnaire is designed to assess compliance (see measures section). A separate survey will be used at the final visit; however the same survey procedures will be followed. During the 3 month study window we expect up

to 4 time points (baseline, months 1, 2 and 3(the final visit). If visits do not fall every 4 weeks, then fewer interim data points will be collected.
Measures: We will gather data from a variety of sources including EMR documentation (for standard of care visits) as well as subject surveys.

Exposure: Using the two-single arm study design, we will compare Kurbo vs. our known standard and Kurbo + PHC vs our known standard. Our standard of care estimates are based on existing data from a 6 month Baystate pediatric weight management spinoff called MIGHTY. Both MIGHTY and Kurbo could be considered augmented programs that spin off of our pediatric weight management program. MIGHTY stands for Moving, Improving, and Gaining Health Together at the YMCA. It is an intensive six-month group program that emphasizes physical activity, nutrition, and change of habits for the entire family. It includes a fitness evaluation, individual fitness prescriptions, group exercise sessions, individual and group nutritional counseling as well as strategies for maintaining lifelong health. Families who participate in MIGHTY receive a free six-month membership to the Springfield YMCA. Children interested in enrolling in MIGHTY must first be evaluated through our Pediatric Weight Management Program. Estimates from this program will be adapted for our power calculations.

If we can establish that Kurbo is better than our known standards, then we will estimate differences between Kurbo vs. Kurbo + PHC. Group assignment will be randomized in a 1:1 ratio using random permuted blocks.

A Pilot Study to Assess the Compliance and Impact on Weight of Kurbo, a Pediatric Centered Weight Loss App
Clinical Trials ID NCT02880254
Outcomes

Compliance: The compliance measure from our known standard (MIGHTY program) is showing up for a visit (e.g. attendance). As comparable measures, we will define compliance with Kurbo app to be daily use for tracking food intake, exercise, accessing the app features (games, badges). Surveys will have specific questions such as: "Over the last month, how many days per week do you usually use Kurbo to track food?" A summary compliance score will be calculated as follows: we expect subjects to use Kurbo to track food daily (7 days per week). Over the 3 follow-up study visits, if a subject responds to the above question with a 7, 5 and 6, we will take the average of this and divide it by the expected. In the above example: 18/3 = 6 and 6 / 7 = 85.7% compliant. Expected compliance for using Kurbo to track exercise = 7 days. There is no expected compliance for the use of games and obtaining badges.

Compliance with the PHC will be assessed based on the subjects' ability to have these meetings at least once a week. In order to collect this information we will ask "Over the last month, how many total meetings have you had with your personal health coach?" Compliance will be assessed in the same way as defined above with the expected compliance of 4 times in the last month. Use of the coaching feature will be defined as a complete phone or video conference. We will also assess the number of times they needed to reschedule these PHC visits.

BMI-z score: This is standard of care data that is recorded in PEDRO. The research coordinator will gather relevant BMI-z score data from PEDRO and enter it into REDCap for all study visits.

Covariates: We will collect the following from the EMR (age (yr, mo), height (cm), weight (kg), insurance category (private vs public), sex, race, and ethnicity). We will also ask subjects what their current grade level is.

Study Timeline: We plan to recruit 70 subjects within the first 6 months of protocol acceptance. With nearly 22 new patients a week we do not anticipate that recruitment will take longer than 2 months, however we will leave our recruitment window open for 6 months at which time we will close recruitment, even if we have not accrued 70 subjects. As the Kurbo intervention is 3 months in duration, we expect the full implementation of this study to last approximately 9 months. Data analysis will be initiated by the EBRC at the completion of data collection. We anticipate analysis to take 3 months.

Prior Studies and Feasibility: As this is a pilot study, no preliminary studies have been conducted in support of this study. We anticipate timely recruitment given the high volume of new patients in our weight management clinic. In order to establish feasibility for a larger study, we will measure participant compliance and other feasibility measures with this pilot study.

The Principal Investigator has experience in conducting retrospective trials, drug treatment trials, prospective and randomized controlled trials during her time at Baystate as well as during her fellowship. Other members of the team, including the research coordinator and other providers, have also had some research experience in retrospective and prospective randomized controlled trials.

Data Analysis: We wish to evaluate two outcomes (compliance and BMI-z score change) among two groups (Kurbo and Kurbo + PHC). To do this we will use two single arm studies, where subjects will be randomized into either group, however each will be compared to a known standard. In this case, the known standards (based on existing data from our usual care group) are based on a 6-month compliance rate of 50% and a BMI-z score decrease near 2% (BMI-z score at baseline=2.27 vs. 6 months=2.22). To adapt these to a 3-month intervention, we feel that compliance at 3 months will remain the same (50%) and BMI-z change will be around 1% (BMI-z score at baseline=2.27 vs. 3 months=2.25).

Upon completion of the study, data will be inspected for outliers and logic checks will be conducted. Initial results will include means, standard deviations, medians and ranges for continuous measures and frequencies and percentages for categorical measures. Graphical representations will be utilized as needed.

To assess our hypotheses we will utilize one-sample tests with a one-sided alpha of 0.025. One-sided tests will be used as we are only interested in whether the use of this app results in better outcomes than usual care. Compliance will utilize a binomial probability test to assess compliance (calculated over 3 months) against our known compliance of 50%. BMI-z score change (absolute change from baseline to 3 months) will utilize a one-sample t-test to assess observed BMI-z score change at 3 months against our estimated change of a 1% decrease. We will present our findings graphically, along with point estimates and one-sided 97.5% confidence intervals.

Assuming we find improved compliance and BMI-z scores, we will also estimate compliance and BMI-z score differences between Kurbo and Kurbo + PHC. Estimates will be generated using direct observation as well as prediction through modeling (e.g. GEE, linear mixed models). As data will be collected monthly, we will also describe changes over time and any possible dose-response effects. We will also evaluate possible differences in effects based on age category stratification (10-14 yrs and 15-17 yrs). We will present our findings graphically, along with 95% confidence intervals. These results may be used to inform study design and power calculations for a future study assessing differences between Kurbo and Kurbo + PHC as well as changes in obesity-related comorbidities.

Power and Sample Size: Studies in pediatric and adult weight management trials indicate that the attrition rate is poor (4, 6, 8) as well as unpublished data from our pediatric weight management spin off program, MIGHTY, indicate that 6 month compliance (attendance) is close to 50% and 6 month change in BMI-z scores is approximately a 2% decrease with a change standard deviation (SD) of 0.12. As described in our data analysis section, we will estimate compliance to be 50% and BMI-z decrease 1%. We will keep the same SD of 0.12. Sample size calculations assume a one-sided alpha of 0.025, and power of 0.80.

In regards to compliance, we feel that to be of clinical importance we would want to observe close to 75% compliance with the Kurbo app and/or Kurbo + PHC. With a sample of 30 subjects in each Kurbo group (60 total), we would be able to conduct a one-sided, one-sample test against 50% compliance if we observe at least 75% compliance in our study groups (a 25% improvement in compliance). Larger samples would be required to test a smaller effect size (e.g. nearly 50 subjects per group would be required to test 70% compliance against 50%) and with the same sample size power would drop to 0.59 to test a 20% difference.

In regards to BMI-z score change, we feel that to be clinically relevant we would want to observe at least a 5% decrease (BMI-z score at baseline=2.267 vs. 3 months=2.154) in BMI-z score over a 3 month period

with the Kurbo app and/or Kurbo + PHC. With a sample of 12 subjects in each group, we would be able to conduct a one-sided, one-sample t-test against a 1% decrease assuming a standard deviation of 0.12 if we observe at least a 5% decrease in BMI-z score in our study groups. Effect sizes greater than the 4% difference described above will be picked up by this sample size. However, in the case that we have underestimated the SD, the upper limit of the 95% confidence interval is 0.14. With this SD we would need 19 subjects to detect this same effect.

If we progress to a comparison between Kurbo vs. Kurbo + PHC, we will utilize a repeated measures model such as GEE or linear mixed models. As we have no preliminary estimates of variability or correlation over time, we have estimated the sample required for a medium effect size of 0.50 (Cohen's d, calculated as the difference between means divided by the pooled standard deviation) assuming a two-sided alpha of 0.05, power of 0.80 and 4 repeated measures with a correlation of 0.3. In this case, we would need to sample balanced groups of approximately 28 each. If the correlation increases (e.g. 0.5 or 0.7) power will increase.

Based on the above information, in addition to adding ~20% for possible study withdrawal, we wish to recruit a total of 35 subjects in each Kurbo group for a total sample size of 70 subjects. This sample size should allow us to assess clinically relevant outcomes with sufficient power.

A Pilot Study to Assess the Compliance and Impact on Weight of Kurbo, a Pediatric Centered Weight Loss App
Clinical Trials ID NCT02880254
Risks and Benefits

The greatest risk is loss of confidentiality. In order to minimize risks, we are implementing the data security plan outlined below. The benefits of using the program include potential weight and BMI loss as well as increasing education on healthy food and exercise choices.

Data Security and Confidentiality

Data will be held within a Tufts REDCap database, which is accessed only by the statistician, research coordinator and principal investigator. All HIPAA identifiers will be tagged and download access will be restricted to coded data for users. Any required dates will be date shifted using the REDCap date shifting algorithm. All email communications between study personnel will be conducted using Baystate email accounts. Coupon codes will be provided to the RC by Kurbo so that purchase of the PHC can be accomplished.

A Pilot Study to Assess the Compliance and Impact on Weight of Kurbo, a Pediatric Centered Weight Loss App
Clinical Trials ID NCT02880254

Significance and Innovation

Children are not considered 'little adults' with regard to health and wellness. Therefore, we cannot assume that interventions that have been studied in adults will have the same outcome in adolescents and children. Studies have assessed the use of weight loss apps in adults and have found successful weight loss can be achieved with their use. However, such apps are not designed for use in the pediatric population, where the important balance of sufficient intake to grow vertically while not growing horizontally needs to be achieved for success. Kurbo is an app that is targeting this population and if validated by a pediatric weight loss clinic, could become an essential adjunct to weight loss programs around the country.

In addition, the tool is free, while the added dietitian support requires a nominal fee that is not more expensive than the cost of additions to other free apps or online weight loss programs for adults. These tools could be easily obtained by adolescents and children looking for guidance in achieving a healthy weight. Should results be positive and indicate significant improvements in BMI z-score, our next step would be to utilize the app and personal health coach features in a larger group of children and adolescents, whereby we will also be able to assess changes in comorbidities of obesity, including hypertension, pre-diabetes, hyperlipidemia, non-alcoholic fatty liver disease and insulin resistance.

References

1. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. Journal of the American Medical Association 2014;311(8):806-814.
2. Booth HP, Prevost TA, Wright AJ, Gulliford MC. Effectiveness of behavioural weight loss interventions delivered in a primary care setting: a systematic review and meta-analysis. Family Practice 2014; 31(6):643-653.
3. Muhlig Y, Wabitsch M, Moss A, Hebebrand J. Weight Loss in Children and Adolescents Dtsch Arztebl Int 2014; 111:818-24.
4. Cheng JK, Wen X, Coletti KD, Cox JE, Taveras EM. 2-Year BMI Changes of Children Referred for Multidisciplinary Weight Management. Int J Pediatr 2014; 1-7.
5. Pew Research Center, April, 2015, "The Smartphone Difference" http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/
6. Carter MC, Burley VJ, Nykjaer C, Cade JE. Adherence to a Smartphone Application for Weight Loss Compared to Website and Paper Diary: Pilot Randomized Control Trial. J Med Internet Res 2013; 15(4):e32.
7. Mateo GF, Granado-Font E, Ferre-Grau C, Montana-Carreras X. Mobile Phone Apps to Promote Weight Loss and Increase Physical Activity: A Systematic Review and Meta-Analysis. J Med Internet Res 2015; 17(11):e253
8. Franz MJ, VanWormer JJ, Crain AL, Boucher JL, Histon T, Caplan W, Bowman JD, Pronk NP. Weight-loss outcomes: A systematic review and meta-analysis of weight-loss clinical trials with a minimum 1-year follow-up. J Am Diet Assoc 2007; 107:1755-1767.