

**Developing a Behavioral Weight Loss Intervention for Emerging Adults Implemented
Within College Health Service Centers**

NCT05895461

Document Date: 8/19/2024

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Background

Approximately 40% of emerging adults (age 18-25) have overweight or obesity¹ and over 85% of these individuals will maintain overweight or obesity as they age, leading to significant health risks.²⁻⁵ Despite the prevalence and seriousness of obesity in emerging adults, this age group is underrepresented in behavioral weight loss interventions (BWLIs), has high drop-out rates, and experiences poor weight outcomes.^{6,7} In the few BWLI studies targeting emerging adults, recruitment has been challenging.^{8,9} One potential way to improve participation and reach is to offer BWLIs in college health service centers. Approximately 40% of emerging adults in the US are enrolled in a postsecondary institution¹⁰ and college health centers are used by 40-50% of eligible students.¹¹ Offering BWLIs in this setting could reduce participation barriers that are frequently cited by emerging adults¹² by providing convenience and time benefits, promoting easier recruitment and allowing for sustainable programming. However, despite the 2020 Healthy Campus Student Objective to decrease the percentage of students with obesity on college campuses,¹³ most campuses do not offer evidence-based weight management interventions and obesity rates in college populations continue to rise.¹⁴

Using design features that are responsive to emerging adult preferences may also improve intervention effectiveness and attractiveness. Emerging adults indicate preferences for BWLIs that promote autonomy, are flexible and easy to use, and involve a limited time-commitment.¹² One primary component of traditional BWLIs is a calorie prescription, which can require comprehensive behavior change and include a large time commitment primarily to self-monitor daily intake.¹⁵ This approach does not align with emerging adult preferences and is difficult to implement in college environments that promote unhealthy eating practices and chaotic routines. The “small change” (SC) approach, which focuses on a series of self-selected, specific changes to current obesogenic behaviors (e.g., using skim instead of whole milk) to create a negative energy balance is a better fit.^{16,17} SC reduces time related to self-monitoring and is theorized to require less cognitive and behavioral effort and to increase autonomy, self-efficacy and maintenance of behavior change.^{16,17} SC interventions are effective for *weight gain prevention* in young adults aged 18-35¹⁸ and lead to *weight losses* of 3-5 kg in 3 months in adult men and women.^{16,19} Preliminary work suggests that a SC approach for *weight loss* is acceptable for emerging adult college students,²⁰ however, a BWLI using SC has not been tested.

Objectives

This study will leverage knowledge from formative work engaging with college health center staff and administrators and students to test an adapted small change behavioral weight loss intervention for college students in college health centers. The goal is to reach pre-specified benchmarks for retention, adherence, acceptability, and weight loss.

Study Design and Procedures

This study will utilize a series of single-arm pilot studies during which mixed methods will be used to iteratively improve BWLI-College and ensure its fit in the current college climate. Adaptations to a clinical innovation are a natural part of any implementation project and user-informed refinements are crucial for enhancing both patient-level implementation (e.g., feasibility) and effectiveness outcomes (e.g., weight loss).^{21,22}

Interested individuals will complete an initial screening questionnaire to determine eligibility. Individuals eligible per the screener will be invited to an appointment with the study staff during which the informed consent process will occur, eligibility will be confirmed via measures and questionnaires, and baseline assessments will occur. Enrolled participants will take part in the 10-week intervention described in the Treatment section. Following participation, participants will take part in a focus group to provide feedback on the intervention. After each cohort, the study team will meet to discuss feedback and will then revise the intervention accordingly. The revised intervention will be offered in a subsequent academic semester with newly recruited participants. Iterative development and testing will continue until pre-specified benchmarks are achieved.

Participants

Recruitment. Recruitment will occur at an institution of higher education in New England. Recruitment will occur via provider referrals, advertisement in university newspapers and websites, on-campus flyers, tabling on campus, social media postings, and class/department announcements and emails

Inclusion Criteria.

- Enrolled in full- or part-time capacity at the institution
- Age 18-29 years old
- $BMI \geq 25 \text{ kg/m}^2$

Exclusion Criteria.

- Currently enrolled in a formal weight loss program
- Past or current anorexia nervosa or bulimia nervosa
- Current alcohol use disorder
- Psychiatric hospitalization in the past 12 months
- Current or recent pregnancy
- Recent weight loss of greater than 5%
- History of bariatric surgery
- Current use of medications used for weight change
- Severe food or physical activity restrictions or medical conditions that interfere with treatment activities.

Treatment

BWLI-College will be a multicomponent behavioral weight management intervention that aims to reduce weight through diet, physical activity (PA), and behavioral modifications. It is based on an empirically-supported small changes weight management intervention¹⁸ that utilizes evidence-based principles for weight loss (e.g., frequent self-weighing) and is adapted for emerging adult college students (Table 1). Notably, per the nature of the study, some features of the described components were adapted across the course of the study. Nevertheless, the general principles described below are consistent across revisions.

The theoretical framework of BWLI-College is based on the COM-B model of behavior change, which indicates that the three broad mechanisms underlying behavior change are capability,

opportunity, and motivation.²³ The COM-B will be used in combination with the Theoretical Domains Framework (TDF)²⁴, which is commonly used with the COM-B and provides additional specificity on behavioral change targets.²⁵ BWLI-College will employ strategies to target capability, opportunity, and motivation, and will specifically emphasize strategies that target behavioral self-regulation (a component of psychological capability) and self-efficacy (a component of reflective motivation), both of which are consistent mediators of obesity interventions.²⁶ The COM-B and TDF models have been used to explain diet and physical activity behaviors specifically in young adults.²⁷

BWLI-College will be delivered over 10 weeks, a duration that fits comfortably into a typical semester. Initial cohorts were offered 4 in-person sessions and 12 asynchronous online modules during the 10 weeks and later cohorts participated in 10 weekly 75-90-minute group-based sessions. Sessions for later cohorts were offered all in-person (cohort 3) or offered both in-person and via a HIPAA-compliant video conferencing platform (cohort 4). Additional materials and resources will be offered via a study website.

Each session will focus on diet or PA and will integrate evidence-based behavioral skill development (e.g., stimulus control, problem solving) and stress management and emotion regulation strategies throughout to address college-specific behavior change barriers, such as time constraints, healthy food availability, dietary knowledge, budget constraints, and social pressures^{28,29} (Table 1). Information on campus-specific resources for psychological difficulties will also be provided. Session 1 will introduce energy balance, small change (SC) concept, and teach self-monitoring, including initiation of frequent self-weighing, a safe and highly effective weight loss strategy.³⁰⁻³³ Between sessions 1 and 2, participants will complete detailed daily self-monitoring of food intake and MVPA to identify existing strengths and areas for improvement, to provide insight into health value of commonly eaten foods, and to guide PA goal setting.

Diet recommendations will follow a SC approach, which involves small, self-selected tweaks, instead of large overall changes, to current obesogenic behavioral patterns.^{18,34} As such,

Table 1. Session Topics

1. HealthyU Introduction
2. Making Small Diet Changes
3. Increasing Physical Activity
4. Reducing Portion Sizes
5. Environment and Social Cues
6. Problem Solving and Motivation
7. Mindful Eating
8. Lifestyle and Sedentary Activity
9. Prioritizing Health in Routines
10. Relapse Prevention

changes are easier and less disruptive to implement, which is theorized to reduce feelings of deprivation and increase self-efficacy, ultimately making them more feasible to initiate and maintain over time.¹⁷ Importantly for emerging adult college students, participants using SC also set their own goals for behavior change, increasing ownership and promoting individual choice and personalization.¹⁷ Furthermore, by identifying discrete and specific behaviors to monitor instead of total calorie intake, SC also reduces cognitive load,³⁵ is easy to do in settings where calorie information is not

available (e.g., dining halls), and reduces burden and stress of treatment activities (e.g., time to look-up and record calorie information¹⁵). The SC approach is aligned with the COM-B model as it builds reflective motivation (e.g., self-efficacy), is responsive to physical limitations and opportunities of the college environment, and fosters aspects of psychological capability (e.g., behavioral regulation) while reducing the deployment of cognitive effort.

In BWLI-College, participants will be asked to make small dietary changes that target increasing healthy foods (e.g., fruits, vegetables, low-fat proteins), decreasing foods that are nutrient-poor and calorie-dense (e.g., confectionary items, fried foods), and reducing portion

size. Small changes will be self-selected and will be informed by individual dietary habits assessed via baseline dietary questionnaire to incur maximal effect. Participants will have personalized goals for the number of small changes to make each day. Goals will vary based on participant starting weight, weight loss goals, activity level, and gender. The range of recommended daily small change goals will generally be between 3-7 per day and participants will work during sessions to identify small changes that can be used to reach this daily goal. For example, one specific SC strategy would be to reduce sugar-sweetened beverages and concrete recommendations for use could be to drink seltzer water instead of soda (-150 kcal) or to order a small 12 oz. flavored espresso drink instead of a 24 oz large (-120 kcal).

PA recommendations will be to achieve 150-250 weekly minutes of moderate-to-vigorous PA (MVPA). An upper goal range of 250 minutes is indicated as 67% of 18-24 year olds in the SNAP trial were already achieving 150 min bout-related MVPA per week at baseline, although MVPA varied widely.³⁶ Given heterogeneity, rate of progression to this goal will be individualized based on participants' baseline MVPA (as indicated by baseline PA assessment and week 1 self-monitoring) and preferences. All participants will be encouraged to have an end of program goal at least 50 minutes more than their baseline MVPA or until they reach 250 min/week. Participants who begin the program with 250 min/week or more will be encouraged to increase the intensity of their physical activity. Participants will learn incremental ways to increase physical activity (e.g., increase frequency, intensity, and duration), to plan for physical activity, and to trial different types of physical activity to find types they enjoy.

Participants will be encouraged to self-monitor behavioral strategies and weight daily throughout the program. Self-weighing will be taught as a skill for self-regulation and a way to monitor goal progress, with an emphasis placed on treating weight as objective data and reducing emotional reaction; nevertheless, participants may reduce their self-weighing goal to four times per week depending on their preference. Text message reminders to complete self-monitoring will be sent between sessions. Participants will also receive text messages that include educational tips or motivational messages to aid in participant adherence and engagement.

Standardized, tailored feedback will be given weekly via email based on progress and achievement of each of the program goals (e.g., weight change, daily weighing, PA minutes, and small change success) as well as additional content goals (e.g., stress, sleep). Participants will be encouraged to maintain strategies if weight goals are met or to modify behaviors if not (e.g., increase daily SCs). Feedback will provide positive reinforcement and constructive suggestions to promote participant motivation and goal attainment.

Measurement

Assessments are completed at baseline and post-treatment (10 weeks following baseline).

Demographics. Participants will report age, sex, race/ethnicity, and other demographics at baseline.

Anthropometry. Height will be measured using a stadiometer to the nearest 0.1 cm. Body weight will be measured in triplicate using a digital scale to the nearest 0.1 kg. The average of 3 height and weight measurements will be used for analysis.

Food Intake. Food intake will be measured by the Dietary Screener Questionnaire (DSQ), which was developed by the National Cancer Institute and used in the National Health and Nutrition

Examination Survey. The questionnaire contains 26-items and captures intakes of fruits and vegetables, dairy/calcium, added sugars, whole grains/fiber, red meat, and processed meat. It has shown good test-retest reliable and high levels of agreement with the 24-hour recall gold standard measurement of diet.³⁷ Eating habits will be examined with the Eating Habits Questionnaire, which asks about meal patterns and consistency, eating outside of the house, meal planning, and alcohol use.

Physical Activity. Physical activity will be measured with the Global Physical Activity Questionnaire (GPAQ), which is a brief assessment of physical activity related to work, travel and recreation as well as sedentary behavior. Developed by the World Health Organization, the GPAQ is widely used worldwide and has been demonstrated as a valid measure of physical activity with acceptable reliability.^{38,39}

Feasibility, Acceptability, and Appropriateness. Feasibility, Acceptability, and Appropriateness will be measured with the Feasibility of Intervention Measure, the Acceptability of Intervention Measure, and the Intervention Appropriateness Measure (AIM, IAM, FIM)⁴⁰ at post-treatment.

Data Analysis

This study is a proof-of-concept pilot trial and as such, inferential statistics will not be employed. Benchmarks of pilot success are average retention of $\geq 70\%$, completion of $\geq 75\%$ of sessions and self-monitoring reports, acceptability ratings of ≥ 4 (out of 5), and mean weight losses of $\geq 3\%$. Whichever benchmarks are not achieved will be targeted for adaptation. A $\geq 3\%$ weight loss is recommended in clinical guidelines due to associations with clinically-significant cardiometabolic changes¹⁰ and is an ambitious, yet feasible weight change based on other trials in emerging and young adults.^{41,43,69}

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