Texting for Health: The Use of Participatory Methods to Develop Healthy Lifestyle Messages for Teens

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ABSTRACT

Objective: To develop and test messages and a mobile phone delivery protocol designed to influence the nutrition and physical activity knowledge, attitudes, and behavior of adolescents.

Design: Nine focus groups, 4 classroom discussions, and an 8-week pilot study exploring message content, format, origin, and message delivery were conducted over 12 months using a multistage, youth-participatory approach.

Setting: Youth programs at 11 locations in Arizona.

Participants: Recruitment was coordinated through youth educators and leaders. Eligible teens were 12-18 years old and enrolled in youth programs between fall 2009 and 2010.

Phenomenon of Interest: Adolescent preferences for messages and delivery of messages.

Analysis: Qualitative data analysis procedures to generate themes from field notes.

Results: One hundred seventy-seven adolescents participated in focus groups (n = 59), discussions (n = 86), and a pilot study (n = 32). Youth preferred messages with an active voice that referenced teens and recommended specific, achievable behaviors; messages should come from nutrition professionals delivered as a text message, at a frequency of ≤ 2 messages/day.

Conclusions and Implications: More than 300 messages and a delivery protocol were successfully developed and tested in partnership with adolescents. Future research should address scalability of texting interventions; explore dose associated with changes in knowledge, attitudes, and behaviors; and offer customized message subscription options.

Key Words: adolescents, mobile health, diet, health education, community-based participatory research

INTRODUCTION

The high prevalence of obesity in adolescents continues to be a significant public health challenge.1 Specific food items and food consumption behaviors are associated with increased obesity risk in youth, including inadequate intake of calcium-rich food, fruit, juice, and vegetables; breakfast skipping; increased eating frequency; and high consumption of sweetened beverages, total calories, and dietary fat.2 Recent survey data suggest that less than 10% of adolescents met national guidelines for vegetable consumption or remained under the recommended limit for discretionary calories (ie, food high in added sugars and fats).3 At the same time, there have been population-wide increases in consumption of food away from home,4 increased sweetened beverage consumption,4 and increased snacking between meals on high-calorie food,5 all of which potentially displace lower-calorie, more nutrient-dense choices. Low levels of moderate-to-vigorous physical activity exhibited by adolescents and a high proportion of time spent engaged in sedentary behaviors (specifically, television viewing) have also been associated with obesity risk.5 Taken together, these data suggest specific areas of focus around which a nutrition education and physical activity promotion program may be structured.

A broad range of intervention strategies has been used to prevent childhood obesity, and current evidence remains insufficient to determine which intervention components contribute to beneficial outcomes in adolescents.6 The current consensus is that intervention programs targeting adolescents combat obesity with limited, short-lived success. The majority of traditional approaches employed to date have relied on expert-led fitness and nutrition education programs delivered within the school setting.7,8 New approaches are needed to effectively engage teens in age-appropriate, teen-centric, relevant activities that can be sustained.
beyond traditional health promotion settings.9-11

The ubiquity of mobile phone use among adolescents offers an engaging, youth-friendly avenue through which to promote healthy behaviors.

Adolescents are heavy users of mobile phones and SMS (short message service, or text messaging) applications. Indeed, national data reveal that 75% of youth between the ages of 12 and 17 years own a cell phone and over one half of those teens send 50 or more text messages each day.12

Although mobile technologies present clinicians, educators, and researchers with new opportunities to reach youth with information and strategies to promote health behavior change, their use as intervention tools also presents new challenges.13 The informal nature of mobile phone-based communication is appealing to adolescents. However, the use of this abbreviated communication method (SMS is limited to 160 characters) for health communication requires a creative, thoughtful approach to message design and delivery to ensure accuracy of message content. Designing appealing messages is also important—for example, those that address health topics of interest to teens, using a youth-friendly “voice” or style, and arriving at a frequency that is acceptable to adolescents. Finally, it is important to determine youth preference for message origin (or sender). Despite the fact that the majority of adolescents use SMS as their primary method of communication, it should not be assumed that messages sent from outside their social circles (eg, from a teacher or health professional) would be desirable or even acceptable.

At present, there is little guidance on the use of SMS to promote nutrition and physical activity behavior change in youth for the purposes of obesity prevention. A literature search identified 2 pilot studies that tested SMS as a method to improve diet and physical activity behaviors in children and adolescents.14,15 The first study enrolled 58 six- to eleven-year-old children and their parents and found no effect on children’s consumption of sweetened beverages, physical activity, or screen time after an 8-week, twice-daily SMS intervention.14 The second study enrolled 120 sixteen- to nineteen-year-olds and focused specifically on changes in physical activity intentions over 2 weeks of daily SMS; the study found only a modest effect on intentions and on behavior at post-measurement.15

Given the increasing prevalence of mobile phone use among teens and that SMS messaging is 1 of the preferred forms of communication for this age cohort, it is critical for health researchers and interventionists to gain a better understanding of how and to what extent SMS can be used to influence adolescent knowledge, attitudes, and behaviors related to diet and physical activity.

To this end, the purpose of this study was to explore preferred message content, format, style (or message “voice”), origin, and frequency and mode of message delivery from the perspective of adolescents. Using a youth-participatory approach (ie, involving youth in intervention design, testing, and evaluation), this study was designed to explore 2 questions: (1) how and to what extent popular technology (ie, mobile phones and text message software applications) would be an acceptable way by which adolescents could receive messages that promoted healthy lifestyle behaviors (ie, diet and physical activity); and (2) whether involving youth in the development process would yield a series of messages that they considered relevant to their lifestyles and were easily comprehensible.

METHODS
Design
A series of focus groups, classroom discussions, and an 8-week pilot study were conducted over a period of 1 year to explore message concepts and to test messages and a message delivery protocol. Data were collected in 3 phases using a youth-participatory approach: Phase I, identification of content and initial message development; Phase II, message testing and refinement; and Phase III, pilot-testing of a message delivery protocol using study-provided mobile phones and messages developed and refined in Phases I and II.

Recruitment
Participants were adolescents between the ages of 12 and 18 years, recruited from 11 youth programs. Programs that did not explicitly focus on health were targeted for recruitment activities; one-third of the programs enrolled low-income populations, many of whom were Hispanic. Programs were contacted based on previously established relationships with the University of Arizona. Eligible youth were active members in 1 of the 11 programs during the fall of 2009 through the summer of 2010. In order to capture a broad range of youth interests and perspectives, participants were intentionally recruited from programs with diverse goals and areas of focus, including: environmental stewardship, social justice, science and technology, civic engagement, youth leadership and development, and the arts (music, dance, and design). Recruitment activities were coordinated through program leaders, who announced the opportunity through letters sent home to parents. Written parental permission and minor assent were obtained from youth who wished to participate in research activities. Permission to conduct all research activities was obtained from the University of Arizona Institutional Review Board following an expedited review.

Data Sources and Collection
The goal of Phase I was to identify nutrition and physical activity content from which to construct messages and to develop sample messages for testing. Potential content was identified using several strategies, including: (1) a literature search conducted by the research team to identify behaviors associated with the development of adiposity in adolescence;16,17 (2) an informal scan of popular or mainstream consumer resources that included nutrition advice and question-and-answer columns (eg, Seventeen, Teen Vogue), as well as
evidence-based consumer sites (eg, United States Department of Agriculture, Centers for Disease Control and Prevention); and, (3) a survey of approximately 100 freshman college students enrolled in a general education course at the University of Arizona who were asked to submit their top 3 questions related to nutrition and physical activity. The research team sorted student questions into general categories, added additional categories based on findings from the literature, and created content that represented each category.

Over 300 messages were developed during this phase by the research team. Message content addressed the following topics: increased total energy intake, high energy-dense diets, increased intake of sweetened beverages, low intake of fruits and vegetables, large portions, frequent consumption of fast food and food away from home, physical activity, and infrequent consumption of breakfast.

Messages were constructed using a variety of formats and styles in order to test which youth preferred. Three types of short messages (“factoids”) were developed for delivery as SMS, and 4 types of longer messages (polls, scenarios, quizzes, and recipes) were created to foster youth engagement with the content.

In Phase II, groups of 6-10 teens were recruited to participate in a series of focus groups, the purpose of which was to identify how youth responded to the concept of text messaging for health, which content and message formats teens thought were appealing and relevant, and to solicit their suggestions for unrepresented topics around which additional messages could be developed. Discussions were led by experts in qualitative research (a medical anthropology team) who had experience in conducting focus groups with teens, and in the analysis of qualitative data.

To guide the discussions, a semi-structured script was developed by the research team consisting of several icebreaker questions, examples of different message formats, and a short activity that guided participants in providing feedback to make messages more appealing to teens. Questions also focused on the modality itself and how participants thought they and their peers would respond to such messages on their phone. Written field notes and audiorecordings were used to document all youth responses during focus groups. Notes were later transcribed and refined as interviewers listened to audiorecordings. Focus group findings were used to finalize message categories and types, which were brought to classroom discussion groups for further refinement.

Four classroom discussions were held at a local high school during science and physical education classes. The purpose of the discussions was to ensure youth were able to read and comprehend message content, and to determine whether message style or “voice” was appealing to teens. Students (20-24 students per class) were shown 25 messages and asked to rate each message as fitting into 1 of 3 possible categories: 1 = “Cool, I want to know more!” indicated they liked the message and it made them curious to know more; 2 = “Okay, but …” indicated they liked the message, but it needed an adjustment to make it more youth friendly; or 3 = “Next!” indicated they did not like the message. Each message was read aloud by a student, and interviewers then asked students to explain the meaning of the message using their own words. The entire class then voted on the category that best fit what they thought about the message. Students were asked to explain why they chose to place each message in a particular category, particularly if they thought the message should not be used. Those who disagreed with the majority were encouraged to provide reasons why they chose a different category. These subjective descriptions of their response to and interpretation of messages were useful to the researchers as they provided guidelines for what was and was not acceptable to youth audiences. As subjective responses varied across students, the more quantitative approach (ie, actually counting how many voted the message as 1, 2, or 3) was necessary to obtain some consensus. Messages categorized by the majority of youth as “1” or “2” were retained for Phase III testing. Messages with a rating of “1” were included as is, and those that received a “2” were revised based on student feedback prior to Phase III.

Guided by Phase II findings, the research team developed a message delivery protocol for testing in Phase III. Four youth groups participated in this 8-week pilot study to determine whether messages delivered via a mobile phone represented a feasible intervention strategy, and whether messages and methods were accepted by youth. Each Phase III participant was provided with a mobile phone (Windows Mobile, HTC Touch Pro 2) for the duration of the study. Although ideally youth would have used their own phones, the researchers had learned through formative research that many teens were unwilling to receive texts if they had limited data plans. At the initial stage of the project, it was thus important for all students to use the same technology. The researchers also wanted to ensure that students of all socioeconomic groups could participate in the program.

Two different software applications were tested: in Weeks 1-4, messages were delivered using the My Experience software application (version 0.9.1, Intel Research Seattle and University of Washington, Seattle, WA, 2009), which triggered messages to “pop up” on participants’ phones at prearranged times each day; during Weeks 5-8, Google’s Voice-to-SMS application was used to send messages at a rate of 1 per day. An additional “teaser” message was sent once a week, which encouraged youth to interact with additional content pre-loaded onto the phone by the research team (eg, “Like to snack but want to be healthy? Check out the Recipes folder HERE to see good stuff you can throw together in 3 steps or less.”) Two members of the research team, graduate students in anthropology) sent the messages, and worked closely with a registered dietitian to answer any questions that youth texted in response. Informal interviews were conducted with participants at the end of 8 weeks to understand their experiences with the device and delivery protocol, and to explore the extent to which youth read, liked/disliked, acted upon, or shared messages with others.

Data Analysis

Field notes and audiorecordings of all Phase II and III study activities served as the foundations of the analysis. Data collection and analysis were
undertaken concurrently. Data were coded and analyzed using deductive thematic analysis, as described by Braun and Clarke. A codebook was developed by the research team to facilitate analysis, consisting of transcripts of audiorecordings and field notes organized by data collection phase (II or III), date, and participating youth group or program. Each dataset was reviewed by the primary interviewer, followed by a secondary interviewer, who was present at the time of data collection. Both interviewers identified recurring themes (defined as answers provided by several youth or agreed upon across the majority of focus group and exit interviews), and met to discuss findings and resolve any discrepancies in data coding. Focus groups were conducted until repetition of participants’ responses was observed. A final summary report with documentation of findings and analysis from each focus group and discussion group was distributed to the research team, who used these data to develop the final message delivery protocol.

**RESULTS**

**Participants**

Nine focus groups (n = 59), 4 classroom discussions (n = 86), and an 8-week pilot study (n = 32) were conducted with a total of 177 participants between the ages of 12 and 18 years. Fifty-three percent of the participants were female. Youth were recruited from local YMCA teen groups, a youth volunteer group, a teen advocacy group, a middle school student leadership club, a charter high school student leadership club, a youth cycling club, a youth environmental club, and science and physical education classes at a local public high school (Table 1). Two of the discussions groups were composed of small friendship groups, as the site from which these teens were drawn was small.

**Phase II Findings**

Overall, focus/friendship group participants were enthusiastic about the idea of receiving nutrition and physical activity messages through their mobile phones. All message formats were well received, however, the short message (or “factoid”) format and the category quizzes were repeated favorites across all focus groups (Table 2). Youth expressed preference for messages that were short, direct, and relevant to teens. Some participants expressed an interest in receiving recipes as messages, but they emphasized that the recipes should be practical and easy to implement without adult supervision.

Participants wanted messages to provide information specific to the teen demographic (eg, “American girls aged 12-19 years old drink an average of 650 cans of soda a year!”), and preferred messages that included personal pronouns (eg, “Eating foods high in protein helps you feel full. Want to see examples of foods that contain protein?”), which teens perceived as “speaking directly to us.” In addition, teens wanted some of the messages to contain content that they referred to as “random” (eg, “Carrots were originally purple in color”; or, “Ears of corn have even numbers of rows”) because they perceived this content to be unique and fun to read and share. Also desirable were messages that provided knowledge that was “translatable” into behaviors related to nutrition, physical activity, or body weight (eg, “Walking can burn 80-100 calories per mile”). Many youth said that simple messages made them want to know more about certain nutrition and exercise topics, and they suggested that “teaser” messages be used to encourage future participants to learn more if they wished (eg, “Too little sleep can lead to weight gain. Click HERE to learn more”).

Message style or “voice” was also important to youth. Teens explained that they did not want to be told what to do and did not like message tones that they perceived as authoritarian. For example, messages that included words like “always” or “never” were generally not preferred. Rather, youth suggested these words be replaced with verbal softeners such as “try” or “consider.”

Youth also suggested additional themes or topics that they wanted to learn more about, including healthy restaurant and convenience food choices, vegetarian eating, dieting for weight loss, how to build muscles or get lean (boys), nutrition to improve the quality of one’s hair and skin (girls), and how the body functions (boys and girls).

<table>
<thead>
<tr>
<th>Program/Site</th>
<th>n</th>
<th>Age range, y</th>
<th>Male/Female</th>
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<tbody>
<tr>
<td><strong>Focus Groups, summer</strong></td>
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<td>and fall 2009</td>
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<td></td>
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<tr>
<td>Youth center</td>
<td>7</td>
<td>12-15</td>
<td>6 M, 1 F</td>
</tr>
<tr>
<td>YMCA, Site 1</td>
<td>3</td>
<td>12-14</td>
<td>2 M, 1 F</td>
</tr>
<tr>
<td>YMCA, Site 2</td>
<td>5</td>
<td>12-14</td>
<td>1 M, 4 F</td>
</tr>
<tr>
<td>YMCA, Site 3</td>
<td>10</td>
<td>12-15</td>
<td>4 M, 6 F</td>
</tr>
<tr>
<td>Youth volunteer group</td>
<td>10</td>
<td>14-16</td>
<td>4 M, 1 F</td>
</tr>
<tr>
<td>Middle school</td>
<td>5</td>
<td>12-13</td>
<td>1 M, 4 F</td>
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<tr>
<td>Charter school</td>
<td>9</td>
<td>16-17</td>
<td>1 M, 8 F</td>
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<tr>
<td>Cycling club</td>
<td>6</td>
<td>13-17</td>
<td>3 M, 3 F</td>
</tr>
<tr>
<td>Environmental club</td>
<td>4</td>
<td>12-14</td>
<td>1 M, 3 F</td>
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<tr>
<td><strong>Discussion groups, spring</strong></td>
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<td>2010</td>
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<tr>
<td>HS science class</td>
<td>22</td>
<td>15-16</td>
<td>12 M, 10 F</td>
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<tr>
<td>HS science class</td>
<td>24</td>
<td>15-16</td>
<td>15 M, 9 F</td>
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<tr>
<td>HS yoga class</td>
<td>20</td>
<td>16-18</td>
<td>9 M, 11 F</td>
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<tr>
<td>HS yoga class</td>
<td>20</td>
<td>16-18</td>
<td>7 M, 13 F</td>
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<tr>
<td><strong>Pilot study, summer</strong></td>
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<td></td>
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<tr>
<td>2010</td>
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<tr>
<td>4-H</td>
<td>4</td>
<td>13-15</td>
<td>2 M, 2 F</td>
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<tr>
<td>Youth center</td>
<td>8</td>
<td>16-18</td>
<td>5 M, 3 F</td>
</tr>
<tr>
<td>YMCA</td>
<td>11</td>
<td>12-15</td>
<td>6 M, 5 F</td>
</tr>
<tr>
<td>Environmental club</td>
<td>9</td>
<td>12-15</td>
<td>4 M, 5 F</td>
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</tbody>
</table>

HS indicates high school.
Although the majority of focus group participants reported owning a mobile phone and using SMS regularly, youth said they would prefer to receive no more than 2 health-related messages per day. Finally, youth wanted these types of messages to come from a credible source, that is, someone who was a perceived as an expert in health or nutrition topics such as a nutritionist.

Discussion groups were used to refine message content to improve comprehension and use a writing style that appealed to teens. Feedback from discussion groups was used to choose final messages and revise them prior to pilot-testing in Phase III (Table 3). Students participating in classroom discussions expressed similar reservations to focus group participants with regard to certain style and word choices (eg, “need to,” “should,” or “recommend”). For example, the message, *The recommended number of hours of sleep per day for teens is 9,* was interpreted by teens as telling them what to do, and to which many youth responded with “We get told what to do, we don’t want to do it!” Messages that began with *Did you know...* were equally disliked, with one participant commenting “Any sentence starting with ‘did you know’ makes me immediately not want to care!” with nods of agreement from other students.

Also like their focus group counterparts, teens in discussion groups wanted all messages to use simple, direct, factual language, and they made suggestions on how to revise messages along these lines. For example, “Reduced-fat foods (like chips and peanut butter) often have sugar added so that the calories are the same as the regular version!” was revised to read, “Advertisers lie to you! They say less fat, but that means more sugar!” Discussion groups also corroborated focus group findings in that youth preferred messages that specifically referenced teens (eg, “2 out of 5 teens don’t eat breakfast!”) and that they were more likely to share these messages with friends because they were “personal” and “you can relate to it.” Surprisingly, some messages that initially seemed to meet general youth criteria (ie, brief, direct, factual) did not rate well in discussions. Two examples included “A can of regular soda has over NINE teaspoons of sugar in it!” described by teens as “boring” and “common knowledge,” and “Overweight teens have a greater chance of having high cholesterol and high blood pressure,” on which youth commented, “we hear this everywhere.” Longer or more complex messages were subject to multiple interpretations by youth and were not as well received.

### Table 2. Message Types and Selected Content from Sweetened Beverage Category

<table>
<thead>
<tr>
<th>Message Type and Definition</th>
<th>Selected Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factoid</strong> - Nutrition and physical activity information in ≤ 160 characters</td>
<td>A can of soda has 10 teaspoons of added sugar.</td>
</tr>
<tr>
<td><strong>Poll</strong> - Participants prompted to respond with typical habits</td>
<td>How many teaspoons of sugar are in one 12-oz. can of soda? (a) 5 teaspoons; (b) 10 teaspoons; (c) I don’t know. Did you know that one 12-oz. can of soda has 10 teaspoons of added sugar? What is your go-to drink when you’re thirsty? (a) soda; (b) water; (c) sports drink; (d) juice.</td>
</tr>
<tr>
<td><strong>Scenario</strong> - Mini-vignettes prompt participants to make choices about nutrition or physical activities</td>
<td>Jesse is tired and thirsty after school and stops at the convenience store to buy a drink. What’s the healthiest drink choice? (a) Fruit drink; (b) Water; (c) Energy drink; (d) Sports drink. What kind of beverage are you? 1. It’s time for breakfast, what do you eat? 2. When you’re thirsty after school, where do you get your drink? 3. What’s the best color for a drink to be? 4. Everyone’s hanging out at your place over the weekend and starting to get bored, do you... 5. Do you like sweet drinks?</td>
</tr>
<tr>
<td><strong>Category Quiz</strong> - 5-item quiz that categorizes participants depending on how they answer each question</td>
<td>Energy drink IQ 1. True or false? Most energy drinks contain the same amount of caffeine (or more!) as a cup of coffee. 2. How many energy drinks are on the market? 3. Guarana is an ingredient in a lot of popular energy drinks. What is it? 4. True or false. A typical energy drink has the same amount of caffeine as the maximum recommended amount for teens. 5. How many gallons of energy drinks do Americans consume in total every year?</td>
</tr>
<tr>
<td><strong>Knowledge Quiz</strong> - 5-item quiz designed to informally test participants’ basic nutrition knowledge</td>
<td>Easy breakfast smoothie: 1/8 cup orange juice; 2 bananas; 4 strawberries (ok to leave out if you don’t have any); 1.5 cups of yogurt. Break bananas into chunks and put in the blender. Add all the other ingredients. Blend on full for 20 seconds. Pour into glasses and enjoy!</td>
</tr>
<tr>
<td><strong>Recipe</strong> - Meal and snack ideas in 3 steps prepared from ingredients typically found in a kitchen</td>
<td>Recipe - Meal and snack ideas in 3 steps</td>
</tr>
</tbody>
</table>
Messages were revised in accordance to youth suggestions (Table 3).

### Phase III Findings

Factoids, quizzes, and recipes were chosen as the message formats sent to youth during Phase III. Thirty-two youth participated in the 8-week pilot study. Informal, small group interviews were used to assess acceptability of messages and delivery methods.

Participants reported that they enjoyed receiving the nutrition and physical activity SMS messages. One youth asserted that “although some of the texts are really cool, others are boring,” a sentiment with which several others agreed, especially when they were already familiar with the information contained in the message. However, others noted that it was useful to have familiar information reinforced, because it “helped you to think about it more.” “Random” messages were rated highly by participants, who reported being more inclined to open additional study-related SMS messages and links to additional content. Several participants said that they showed or forwarded the messages they liked to their family and friends.

The use of SMS also facilitated conversations between participants and the research team. Participants enjoyed being able to text questions back to the research team and receive responses. Questions included, “How many calories can you lose if you run a mile?” in response to “Walking can burn about 80-100 calories per mile,” and “Do you know if teens in other countries drink more or less soda than they do in the US, like how many cans of soda will a Mexican girl drink a year?” in response to “The typical American teenage girl drinks 650 cans of soda per year!”

All pilot study participants agreed that messages that arrived via SMS (using the Google Voice-to-SMS) were preferable to those that “popped up” on the phone at prearranged times, as unlike preset messages, SMS allowed youth participants to interact with the research team through informal conversations or save them for later to forward and share with others.

### Table 3. Message Revisions Suggested by Participants in Phase II

<table>
<thead>
<tr>
<th>Original Message</th>
<th>Rationale for Modification</th>
<th>Type of Modification</th>
<th>Revised or New Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercising helps you feel better about yourself. It gives you pride and confidence in your body.</td>
<td>“Physical activity” was suggested as an alternative to “exercise,” which sounded regimented and not fun. Youth suggested “can” or “may,” since these messages may not resonate with all youth (eg, some might feel less confident when they are physically active or notice no improvement).</td>
<td>Editorial</td>
<td>Physical activity may help you to feel better about yourself because it can give you a sense of confidence in your body.</td>
</tr>
<tr>
<td>Cereal + fruit + milk or yogurt for breakfast gives you a good dose of protein and fiber, which will keep you fuller, longer.</td>
<td>Was not specific enough regarding type of food. That is, youth noted that some cereals are bad for health (sweetened ones, which have little protein) and that the type of milk should be included (2% vs skim). Youth recommended the authors avoid nutrition jargon.</td>
<td>Reduced length of message and specified food type. Eliminated jargon.</td>
<td>Eating whole-grain cereal, fruit, and low-fat milk or yogurt for breakfast will keep you fuller, longer.</td>
</tr>
<tr>
<td>The average teen drinks only 1 glass of milk a day but twice as many sodas. Having too much sugar in your diet can make you gain weight, which puts you at greater risk for diabetes. Teens should get 9 hours of sleep per day.</td>
<td>Youth said: “Messages that are too complex are difficult to understand.” Youth confused the word “diet” with “dieting.” They thought this message was confusing. Youth suggested we avoid using “should” or “need to” and use softer words (leaving them free to make their own choice).</td>
<td>Reduced length of message and eliminated reference to rate of soda consumption. Shortened the message and made it more direct. Eliminated jargon.</td>
<td>The average teen drinks only 1 glass of milk a day but 2 sodas. Caution: Being overweight puts you at greater risk of diabetes. Nine hours of sleep each night is recommended for teens.</td>
</tr>
</tbody>
</table>
DISCUSSION

In this study, a youth-participatory approach was used to engage adolescents in developing and refining nutrition and physical activity messages that were appealing, relevant, and practical for teens to implement. Focus groups and classroom discussions reinforced that teens are sensitive to certain language. For example, messages that used a more authoritarian tone (eg, “You should” or “You need to”) were universally panned by youth, who stated messages should never contain these phrases and noted that “kids don’t like being told what to do.”

Comprehensible, accurate, and concise messages designed with participant input to support healthy lifestyle choices has been recommended as a single strategy to help shift dietary patterns to support optimal health outcomes.22 The current study’s findings suggest these messages should be positive, simple, few in number, and designed to be culturally appropriate for different adolescent subpopulations. In order to inform and motivate youth, messages must address the reality of today’s adolescent lifestyles.23,24 One method is to directly engage youth in iterative discussions about message design and delivery and involve them in the development of messages so that messages are relevant and meaningful to the lifestyles of users.25

Avoid “you should” and “you need to” in messages for teens.

Few studies have explored the construction of messages designed to promote healthy lifestyle behaviors through a mobile device using a youth-participatory approach. In a study focused on weight loss (rather than healthy lifestyle promotion), Woolford and colleagues explored obese adolescent participants’ perspectives related to weight management messages, and they found enthusiasm for SMS as a strategy to support weight loss efforts among these participants.22 Importantly, focus group findings from their study were similar to those of this study in that teen participants desired brief, positive, encouraging messages that had a “natural” tone and made specific reference to the teen demographic.22 Also similar, Woolford’s targeted tips (ie, SMS, which provided advice normed and pretested with youth) were particularly well received by teens, who thought they could easily incorporate these practical suggestions into their routine. Findings from Woolford et al reinforce the current study’s conclusions and emphasize the critical importance of formative research in the development and design of SMS messages targeted to youth populations.

Although overall, the informal, SMS-based approach appealed to youth, it remains unclear whether the messages, once received, will result in changes in diet and physical activity knowledge, attitudes, or behaviors. As this is an innovative methodology in the field of nutrition education, this research entailed working closely with youth in an iterative manner in the development of messages and identifying an appropriate delivery modality. The next step will be to conduct an efficacy study to test the impact of different message “doses” and delivery methods on key health behaviors among adolescents. It is important to note that more broadly in the field of “mhealth” (ie, projects using mobile technologies for purposes of health), most programs can best be described as pilot projects, as they are relatively new in focus and scope. Measures of program success have yet to be adequately defined.

In addition to testing the effect of messages on health-related outcomes, several logistical challenges require careful consideration when this messaging intervention is implemented on a larger scale. In this study, messages were manually pushed to participants using a free, Web-based software application or automatically sent using a preprogrammed, phone-based software application, and the participants carried a study-provided mobile device that included unlimited text messaging. A larger participant population would require a software program capable of automatically sending dozens or even hundreds of text messages simultaneously, while still retaining the interactivity that participants found desirable. An efficacy trial would also need to address the balance between the practical need to automate message delivery while still retaining the necessary level of engagement and interaction with participants.

Further, rather than using study-provided phones, participants must be willing and able to use their own mobile devices to receive study messages (ie, they must have no or few limitations on text messaging allowances). Youth using their own mobile phones may be less tolerant toward receiving messages compared to youth who are supplied with a study phone. Although there are data supporting widespread cell phone use and mobile device access among youth, a clearer picture of access across all demographic groups is not yet available. Indeed, in this study, initial data revealed that only 85% of youth had cell phones, and only 10% of those youth had smart phones.

Although youth enrolled in the pilot study were provided with study mobile phones, reports of message sharing were not substantiated other than by self-report. Future studies should attempt to capture message sharing more reliably as both a quantitative measure (eg, number of times messages were opened, read, or forwarded to others) as well as a qualitative measure (eg, preference for specific messages among teen participants and with whom they shared information).

Diverse teens were purposefully recruited to participate in this study, representing a wide range of ages, socioeconomic backgrounds, and a variety of extracurricular interests. However, the exploratory nature of this research did not allow investigation of age and gender differences with regard to message preferences, or cultural and economic factors that may influence how the messages would be received and acted upon. These are important issues to explore in future studies.

IMPLICATIONS FOR RESEARCH AND PRACTICE

This study demonstrates a novel way in which to engage adolescents in “conversations” about health using
a familiar, favored, and ubiquitous communication method. Rather than being passive recipients of “top-down,” expert-driven communications, youth in this study had the opportunity to actively participate in the message design process and engage with health information through informal interactions with experts and with one another, thereby increasing the likelihood that they adopted the recommended behaviors.

Adolescence is characterized by increased ability for complex thought as well as increased desire for autonomy. To be maximally effective, health interventions should be designed to support adolescents during their transition to adulthood by offering developmentally appropriate information and strategies. Given the current popularity of mobile devices among youth, SMS messages represent an opportunity to support adolescents in their transition to adulthood by engaging youth with information and strategies that foster healthy lifestyle choices and habits. Additional research is needed to determine whether technology-based interventions are an effective, sustainable way to promote healthy lifestyles to adolescents and have a significant impact on behaviors that place youth at increased risk.

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