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Perceptions of Health Behaviors and Mobile Health Applications in an Academically Elite College Population to Inform a Targeted Health Promotion Program

Jennifer L Warnick[1] · Angela Pfammatter[2] · Katrina Champion[2] · Tomas Galluzzi[2] · Bonnie Spring[2]

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Abstract

Background College is a critical developmental time when many emerging adults engage in unhealthy behaviors (i.e., lack of exercise, poor diet, smoking) and consequently experience an increased risk for a decline in cardiovascular health. Understanding the beliefs and opinions of the target population is important to develop effective health promotion interventions. The goal of this study was to understand opinions regarding health and health-related mobile technology of college students at an academically elite Midwestern university in order to inform a mobile health promotion intervention following the integrated behavioral model framework.

Method Eighteen college students between the ages of 18 and 22 participated in one of four focus groups, where they discussed perceptions of health behaviors, technology use, and their college environment. Data were analyzed using inductive thematic analysis as well as consensus and conformity analysis.

Results Students reported prioritizing academic success over health and believed in a cultural norm within the university that unhealthy behavioral practices lead to increased academic success. Other identified barriers to achieving good health were (a) low self-efficacy for engaging in healthy behaviors when presented with conflicting academic opportunities and (b) low estimation of the importance of engaging in health behaviors. Regarding mobile health applications (apps), students reported preferring apps that were visually attractive, personalized to each user, and that did not involve competing against other users.

Conclusion These results have implications for the development of mobile health promotion interventions for college students, as they highlight facilitators and barriers to health behavior change in an academically elite student body.

Keywords Mobile health · Health promotion · College · Technology · Health behavior change

Introduction

Poor health behaviors, such as smoking, poor diet, and physical inactivity, are associated with multiple health risks, such as obesity, cardiovascular disease, cancers, diabetes, and poorer quality of life [1, 2]. Fortunately, these behaviors can be modified (e.g., diet change, smoking cessation, and increasing physical activity), and it is well documented that improvements in health risk behaviors can reduce mortality and disease risk significantly [3]. However, once established, unhealthy lifestyle behaviors can be difficult to change. Unhealthy lifestyle behaviors acquired during the years of emerging adulthood (typically defined as 18–25 years) tend to become habitual and persist into later adulthood [4, 5]. Thus, developing health intervention and promotion programming for this emerging adulthood population is crucial to reduce disease risk.

Although educational attainment is typically associated with better health outcomes [6], college is a time when many emerging adults adopt unhealthy lifestyle behaviors [7–9]. In fact, approximately half of college students do not meet national physical activity or dietary guidelines [10, 11]. Moreover, a 2005 meta-analysis revealed that 40–50% of college students are physically inactive [12]. The proportion of college students that are overweight or obese increases during the freshman year [13], and rates of tobacco use are about 17% in the 4-year college student population. It also has been

✉ Jennifer L Warnick
jenniferlwarnick@ufl.edu

[1] Department of Clinical & Health Psychology, University of Florida, Gainesville, FL 32610, USA

[2] Department of Preventive Medicine, Northwestern University Feinberg School of Medicine, Chicago, IL, USA

shown that emerging adults have extreme difficulty with quitting and are unlikely to quit smoking without assistance or intervention [14–16].

As well as being prevalent among college students, these unhealthy lifestyle behaviors commonly co-occur as risk clusters [17]. Among college populations, research has consistently found risk behaviors, such as physical inactivity, poor diet, and smoking, to cluster together [18–20]. Risk behaviors typically have a synergistic effect, such that the co-occurrence of multiple risk behaviors increases the risk of disease and mortality, more so than the additive effects of single behaviors [21, 22]. A combination of multiple risk factors is especially salient for cardiovascular disease, the leading cause of death for Americans [2]. Increased weight, reduced physical activity, high levels of sedentary behavior, poor quality diet, and tobacco use make college students a particularly vulnerable population for increased cardiovascular disease risk development. Thirteen percent of cardiovascular health (measured according to the My Life Check® Life's Simple 7: by never having smoked, physical activity, and diet consistent with national guidelines, and body mass index (<25 kg/m^2 for adults and <85th percentile in children)) is lost during the college years due to the acquisition of unhealthy behaviors [23–26]. The high degree of fluctuation of behaviors during the college years offers a potential opportunity to pre-empt the development of health risk behaviors before they solidify as bad habits or, stated otherwise, to promote healthy lifestyle behaviors that become habitual.

Several interventions have shown positive effects on college students' weight, daily physical activity, or cigarette smoking; however, few studies have examined multiple health behavior changes [27–30]. Although further evidence is needed to support the effectiveness of multiple health behavior change interventions [22], interventions that promote multiple health behavior changes by targeting several risk behaviors together offer a potentially efficient solution for promoting ideal cardiovascular health and reducing later disease risk among young people [29].

Furthermore, the use of technology, such as the internet, cell phones, social media, and text messaging, is an ideal platform for intervening among college students. Currently, 94% of emerging adults own a smartphone and the majority use their phones' texting and internet capabilities regularly [31–34]. These functions and others, such as push notifications and geolocation, have been leveraged to develop successful behavior change interventions [35–37]. Further, the feasibility of mobile health college wellness programming is supported by the observation that college students respond positively to mobile health interventions when mobile technology is personally tailored to their unique needs [27, 34]. Therefore, advanced smartphone technology holds potential as a delivery mechanism for interventions to promote multiple healthful behaviors among college students.

The integrated behavioral model (IBM), first proposed by Fishbein [38], asserts that behavior change is determined by an individual's (1) attitude (i.e., feelings and beliefs about the behavior); (2) agency (i.e., perceived control and self-efficacy); and (3) perceived social norms regarding the behavior (i.e., peers' behaviors and expectations of the behavior; social pressure to perform or not perform the behavior). These influences determine the individual's intention to perform the behavior and are combined with the individual's environmental constraints, salience of the behavior, habits, and knowledge of how to perform the behavior to determine the likelihood of behavior change [39, 40]. The IBM theoretical model extends the theory of reasoned action and the theory of planned behavior, both of which have guided effective behavior change interventions [40]. IBM is well-suited as a behavior change model to develop an intervention for college students, as it incorporates constructs especially relevant for this age group. For example, emerging adults are highly influenced by their peers [41, 42]. Hence, understanding how students at the target university perceive peers' beliefs and expectations about health behaviors is pivotal for determining individual intentions to perform health behavior changes. Also, college students report difficulty engaging in healthy behaviors as a result of barriers like the lack of healthy campus dining options, time management challenges, and hesitations to exercise in front of others [43]. This suggests that the IBM constructs of environment, habit, control, and self-efficacy may be important barriers for college students' efforts to achieve healthy behaviors. To maximize change behavior, defining the constructs most relevant for college students is necessary to tailor our intervention. The aim of the current study was to assess IBM constructs (e.g., attitude, perceived norms, personal agency) in order to identify facilitators and barriers to healthy lifestyle habits in a college population and to explore potential mobile health (mHealth) levers to foster positive behavior change.

Our ultimate goal was to develop a cardiovascular health promotion intervention for college students using mobile technology. However, prior to the creation of such a program, it was essential to first understand the target population, specifically their attitudes, environment, and perceived social norms regarding health behaviors (e.g., diet, physical activity, and smoking) to develop a program individualized to the target college population's specific needs [44]. Our target college chiefly accepted students with very high educational attainment, a specific demographic whose health behaviors appear to be understudied. Hence, the purpose of this study was to gather data on the specific opinions, goals, facilitators, and barriers of a target academically elite, college student population in order to design an appropriate multiple health behavior mobile health intervention. The present study describes the formative research conducted among this sample to directly inform the development of a mobile health intervention to promote ideal cardiovascular health among this population.

Methods

Participants

Students from an academically elite Midwestern university were recruited via flyers and word of mouth. Eligibility criteria specified being between the ages of 18 and 22, living on campus during freshman year, and agreeing to be audio and video recorded in a focus group setting. Interested candidates completed an online eligibility survey ($n = 25$), after which eligible participants ($n = 18$) were scheduled for focus groups that occurred during December 2014 and February 2015. A saturation sampling strategy was used, whereby participants were continually recruited until no new themes arose from the data collection [45, 46].

Procedures

A qualitative focus group approach was used to collect data about students' perspectives about health and technology usage. Four focus groups were conducted in total. A script was created by the research team to query participants about their attitudes regarding health (e.g., salience of health, perceptions of personal health and wellness), mobile technology (e.g., current usage, opinions about health apps, opinions about a future app), agency (e.g., schedule, priorities), and their college environment (e.g., dorm life, cafeteria). The script incorporated a mixture of concepts from the IBM as well general questions regarding mobile and health-related technologies. Before each focus group, participants were required to provide informed consent; consent for publishing direct quotes was obtained. All students were asked to use pseudonyms throughout the session in order to remain anonymous to the transcribers. A clinical psychologist facilitated all four focus groups using a script that provided a general blueprint for the session; however, students were encouraged to expand upon topics. A research assistant took notes and asked any necessary follow-up questions, and a second research assistant operated the audio and visual tape recordings. Each focus group lasted between 90 and 120 min and included approximately five students. Participants were not compensated for their participation, although they did receive healthy snacks or meals during the session. The university's Institutional Review Board approved all study procedures.

Coding and Analysis

Each session was video- and audio-recorded and later transcribed. Inductive thematic analysis was used to analyze the data, which is a method of identifying, analyzing, and reporting patterns or themes within a data set [47]. The goal of this type of analysis is to explain how and why participants believe and act a certain way. Two coders inductively derived themes (i.e., common patterns) that emerged within the data, without trying to fit the codes to a specific framework or preconceived hypotheses [47]. After developing independent lists of initial themes, the two coders met to compare and contrast their independent lists. The coders met throughout this process to compare and reorganize coded themes to achieve consistency in coding. Discrepancies between codes were resolved through discussion, and coders came to 100% agreement on all codes. NVivo 10 [48], a qualitative software program, was used to identify, code, and categorize themes.

Consensus and conformity analyses were conducted to account for group dissent or agreement on a point of view [49]. Coders watched the video recordings and coded how many participants used body language (e.g., nodding), verbal cues (e.g., "no," "I agree"), or an absence of both body language and verbal cues during discussion of a particular topic. Percentages were used to describe how many participants, in each group and in total, agreed with some of the main themes that emerged from the inductive thematic analysis. The following results will discuss the overarching, broad themes derived from the data as well as the more detailed, qualitative descriptions of agreement and dissent of these themes.

Results

A total of 18 students gave informed consent and participated in one of four focus groups. The researchers determined that saturation was met after three focus groups were held, and one additional group was conducted to confirm saturation. The majority of participants were female ($n = 15$, 60%) and from varied college years (5 freshmen, 2 sophomore, 4 juniors, 7 seniors). Five main themes emerged from the data: disregard for health, priorities during college, discussing health with others, opinions of current mobile applications including pros and cons, and specific smartphone app design suggestions. Students provided their attitudes as well as their perceptions of peers' beliefs and attitudes. Each theme is described in detail below.

Disregard for Health

Students reported feeling moderately healthy, but that they were missing "something in the balance" such as sleep or exercise. Some spontaneously rated their health between a 6 and 7 "healthy" on a scale from 1 (worst health) to 10 (best health). Low stress and sleep were reported to be the most difficult to prioritize, and nearly all agreed that cold weather months and difficult exam periods were barriers to health. Student 14 stated "I believe I'm fairly healthy 'cause I work out like every day, or I try to, but then like finals week comes around and then everything is just terrible because I'm studying all the time." Some expressed problems with hygiene

during these periods as well. Students 7 and 9 described hygiene at the university in the following way: "hygiene is sometimes a problem…taking showers…forgetting to brush your teeth…if you have a paper…if you pull an all-nighter." Overall, students stated that health behaviors were easily disregarded if other priorities, usually academic, emerged.

Although students perceived themselves to be somewhat healthy, they said that health was not important to them unless it impaired their ability to engage in school activities. Some even expressed a blatant neglect for health. Student 3 spoke about disregard for health in the following way: "I would say I think about these things [sleep, nutrition, exercise, mental health, not being sick] all the time… I often complain about those things…but I don't really like actively do anything about it." A number of students expressed a belief that poor health habits are necessary for academic accomplishment (e.g., reduce sleep, skipping meals, eating fast food or Ramen noodles, and foregoing the gym in order to study longer hours), a rationale that, in their minds, justified lack of attention to their own personal health.

Many also reported that living independently for the first time in their lives diminished their engagement in personal health. Living outside the parental home often meant that students needed to take more active steps to engage health resources (i.e., obtaining medicine, seeking doctor's advice) than they did when they lived at home. Generally, this was because those activities required performing actions toward health (e.g., calling the doctor, going to the appointment, walking to the pharmacy) that were previously managed by others (i.e., parents).

Compared to other class years, students believed freshmen were the least interested in health. Freshmen were described as "riding off high school" athletics (Student 10) or "too overwhelmed with everything else [college transition]" to care about health (Student 13). Student 17 characterized his freshman year in this statement: "I mean I personally thought I was like superman in disguise as a freshman…I was like I can just not sleep for like 2 days… who did I think I was?" Similar sentiments were echoed by multiple upperclassmen.

In addition to living independently for the first time and moving to a new environment surrounded by unknown peers, the students described needing to compete against others who were also academically at the top of their high school class, as another freshman-year stressor. Thus, many students who were accustomed to excelling with ease in high school experienced unexpected "failure" during their first year at university. Student 10 explains the pressure she felt:

> I came in my freshman year like feeling like everyone really does. You have like the top whatever percent of your class to get in here…when I came in here I wanted to be a superhero in every aspect and failure wasn't known to me… when I found out what failure was… that's when my health started going down.

Overall, the students described their freshman year experience as one involving an almost overwhelming amount of independence coupled with competition to excel. Many students dated the onset of their growing disregard for health to the experience of encountering this combination of freedoms and stressors during their freshman year.

Priorities During College

Students at this university felt extreme pressures to excel, both academically and socially. They spoke of self-imposed expectations for themselves and felt guilty if they gave themselves free time. In fact, students' often spoke about the importance of maintaining a constant busyness. Student 2 explained this as follows:

> I think students here have free time, but I don't think they would call it free time. It always feels like there's something to be done. So you may be doing nothing, like taking the time to be doing nothing, but you feel guilty about it.

Students explained the perceived campus-wide belief that everything they do in college will determine the success of their post-college careers. They felt compelled to achieve excellence in academic classes, leadership in student groups and organizations, philanthropic work, and additional internships or jobs taken to build a resume. Most students reported prioritizing academics above anything else. In fact, three out of four focus groups ($n = 15$) discussed prioritizing classes first; 86.7% agreed, whereas two students indicated neither agreement nor disagreement.

Augmenting the challenges of excelling both academically and socially, students were learning how to manage their time, navigate a new environment, and take responsibility for themselves for the first time. Many students explained that during freshman year, they learned "the hard way" what "failure" felt like. The stress they felt to maintain excellence in multiple arenas only increased their tendency to push health further down their list of priorities. In addition to academics, students reported prioritizing student groups, their social life, and volunteering above health. Students attributed their priorities to the constant competition they felt to excel and an associated "obsession with being busy." Two groups reported that health is lowest on students' lists of priorities; 88.9% of group members agreed with that statement, with only one person expressing neither agreement nor disagreement. As Student 3 stated:

> I would say it's pretty easy for me to skip a meal or skip a workout if I'm stressed about a project or something or an assignment that I'm working on and I'll honestly not think twice about it; I'll just continue doing work.

These discussions led students to discuss difficulties in time management. Student 16 said, "they [the university] sometimes has seminars on time management, and I know I should go to them, but I don't have the time." Students' spoke of feeling over-scheduled and having difficulty managing their time well. Students' self-reported self-efficacy of healthy behaviors was poor, particularly when academic or student-group activities came up.

Discussing Health with Others

The students expressed comfort in speaking about certain health topics with friends, but stated that some of their friends had radically different perspectives stemming from differences in family history, personal beliefs, and athlete vs. non-athlete status. Because finding common ground about health beliefs was difficult, students reported talking about health primarily in the context of bonding or competing with others over who had exceptionally poor health behaviors. Having extremely poor health behaviors was implicitly justified among the participants by a widespread belief among students that academic success required prioritizing achievement at the expense of a healthy lifestyle. As Student 10 explained, "… like 'oh, I pulled my 7th all-nighter in 3 weeks' ya know, or like, 'I eat like Ramen for every, ya know, meal,' or… 'I haven't worked out all week.' I feel like those are conversations I have every day with like random students." When asked how comfortable students would feel sharing personal health information (i.e., calories, minutes exercised, weight), students seemed uncertain. Student 7 explained this wariness:

> I think talking with friends for me is more like 'ha ha I like forgot to shower today, I've been so busy' or 'I haven't worked out in so long'...but I like don't think I would feel like super comfortable saying like 'how many calories are you eating' or 'is that super healthy for you?'… like I don't think I would do that.

When asked about using social media to post information on how many vegetables they ate or how long they exercised, students strongly discouraged the research team from asking students to use social media to share personal health. As Student 8 stated, "people compete to be the unhealthiest in certain domains." Hence, students anticipated that others would use a social media platform to strengthen their social belief that academic success requires sacrificing health, and would compete to have the unhealthiest behaviors. On the other hand, other students expressed fears that, if it were possible to get students to compete to be the healthiest among their peers, many would be made to "feel bad" for being unable to excel in their health behavior goals. Student 18 described the school's competitive environment in the following statement: "It always seems to be a competition here." Three out of the four focus groups discussed their fear of excessive competition, and 100% of those who discussed this competition felt that comparing health information may make students feel discouraged.

Opinions of Current Mobile Applications: Pros of Mobile Apps

Students were asked which specific mobile applications (apps) they used most often and what they liked the most about those apps. The most commonly reported apps involved social media (e.g., Instagram, Facebook, Snapchat, GroupMe) or productivity (e.g., email, calendar, notepad, weather, maps). Additionally, students reported using their mobile apps most often when taking short breaks or when they were bored. Student 12 explained "it's just a quick way to pass the time and then you can easily put it away whenever. It's not like you're too invested but it's enough to keep your attention when you need it, I guess." App features that students said they enjoyed were the ability to control notifications (i.e., by silencing or turning them off), visual components (e.g., pictures, videos), customizability, novelty (e.g., "I like apps that can do things that I can't do with anything else" (Student 2)), ease of use, and the ability to update in real time.

Few students reported using health apps; some said they had tried them in the past (e.g., MyFitnessPal, Map My Run, Nike+). A few students explained that the health applications they used helped them to begin performing more healthy behaviors for a short time, but eventually lost their utility once students got into a rhythm of exercising or eating well. The most positive statements concerning health and mobile apps came from students who followed fitness gurus on popular social media outlets.

Opinions of Current Mobile Applications: Cons of Mobile Apps

One major complaint about popular mobile apps was the lack of an alternative web-based platform, that is, when a program is available by app, but not in a web browser on a computer (e.g., some features of Instagram, Snapchat). Students indicated a desire to have both the option to use an app on their phone, but also navigate to a website when on a laptop or desktop computer. Another complaint was apps that sent too many "unnecessary" notifications. Students reported that they only enjoy notifications and find them useful when they perceive messages as personally directed toward them, as is the case for new email notifications, private messages, or an update reflecting recognition by others (e.g., likes on Facebook). Otherwise, students found general notifications annoying. Student 4 explained "sometimes apps can start getting annoying like if they send you too many notifications that are not really helpful or informative or um, you add too many ads

onto the app or something, I'll uninstall." Other common reasons students gave for discontinuing use of an app are that it becomes unpopular, stops being personally relevant, stops updating, is replaced by a better alternative, no longer provides new information, takes up too much space on the phone, places too much drain on battery life, becomes too time consuming, or crashes often.

Regarding health apps, the majority reported that using applications were too time consuming; "it was so tedious to like check every single time you, you know, eat something" described Student 4. Others reported that the health applications actually had an adverse effect; Student 7 explained, "maybe you feel really good about a run but then you like look at the app and it's like you only burned this many calories, and then that feels so bad because I thought it was so great. It just like brings it down." No students reported using wearables (e.g., Fitbit).

Specific Smartphone Application Design Suggestions

After discussing technology and health, students gave specific design suggestions for the creation of a new mobile health app. Their first recommendation was for an app to be as personalized and customizable as possible, including having the ability to make location-specific, brief suggestions in real time (e.g., could tell you what to order on the menu of the restaurant you are standing in; suggest healthy opportunities nearby). Students also requested localizing app access in a place that students already go to daily (e.g., to use email or a calendar application). Similarly, many mentioned the importance of the application knowing their personal schedules so they were not disturbed during important meetings or classes, but rather the application could sense available times when students could act upon health suggestions. Students uniformly wanted the design to be easy to use, quick, visually appealing, and require low effort. Students said they were bombarded with events and information already from their university and wanted information to be suggested to them rather than commanded, "maybe not reminders, but notifications saying that there's an opportunity for me" (Student 12). In fact, students spoke at length about the importance of message framing in a health app. They described wanting messages that sounded non-judgmental and non-preachy, and that did not tell them what to do or remind them of things not accomplished. Passive data collection was reported to be more appealing to students than needing to actively input information into an application (i.e., calories, minutes exercised) because it is less burdensome.

Most importantly, students listed specific suggestions for using social media. They stated adamantly that they did not want to be compared to others, especially publicly. Student 4 explained: "As tempting as it is to connect it to social media 'cause that's what's most often used it's probably not going to go down well with Facebook, Twitter, or Instagram, just because that's not why people use those apps." Students reported that they would use social media components in a health app as a way to connect with friends or upperclassmen (e.g., general communication) and to verify the application's popularity on campus (e.g., see other friends using it).

Discussion

The goal of the current study was to determine facilitators and barriers to a mHealth health promotion intervention informed by the integrated behavioral model. Goldstein and colleagues [50] have endorsed the need for a multiple health behavior prevention program for cardiovascular disease prevention in the college population to target behaviors that become increasingly unhealthy during the college years (e.g., diet, weight, physical activity, smoking). The feasibility of mHealth college wellness programming is supported by the observation that college students respond positively to mHealth interventions when mobile technology is personally tailored to their unique needs [34, 35]. The present study is the first step in developing a theory-guided mHealth program geared toward college students.

The current study involved conducting four focus groups with students currently attending a Midwestern university in order to gather information about students' attitudes and beliefs about health, technology, and perceived social norms specific to the target population. Themes that emerged from the focus group transcripts concerned the following: disregard for health, priorities during college, discussing health with others, opinions of current mobile applications, and specific suggestions for health app design. The results indicated that students at this target college did not prioritize health, felt pressured to excel academically and to embody a self-image of "busyness" (i.e., motivation to succeed), and expressed a need to be connected to peers.

Overall, students frequently communicated several messages about health. First, health was often de-prioritized in favor of academic pursuits and social activities. Not only was health viewed as less important, but students engaged in detrimental health behaviors such as not sleeping or eating to make time for other activities—mainly studying or student group meetings. Consistent with the IBM, these results indicate that students' self-efficacy for healthy behaviors was poor when met with alternate academic opportunities. Health salience appeared to differ by individual, yet two discrete descriptions emerged: (1) students maintaining healthy behaviors established in high school—mainly relating to exercise—and (2) students feeling either invincible or overwhelmed during freshman year and foregoing most healthy activities. Findings suggest that some students may not highly value engagement with healthy behaviors particularly during freshman year.

Second, students expressed a strong social norm that being busy, stressed, and unhealthy were necessary to achieve greater academic and/or professional success. Leshed and Sengers [51] have suggested this "culture of busyness" has become common in American culture and reflects the negative connotation that "doing nothing" has in today's society (e.g., laziness). Therefore, students' expression of wanting to stay busy shows both a cultural norm as well as an ingrained personal value. Further, students described a cultural belief within their institution that staying busy and engaging in unhealthy behaviors led to academic success. Despite these unhealthy beliefs, some upperclassmen did say that they devoted more attention to health behaviors later in their college careers, after learning that sustainability of unhealthy behaviors (e.g., complete lack of sleep, poor nutrition) was untenable. Thus, the results highlight two important barriers to health in this population: (1) students do not believe health behaviors are as important as other college experiences (e.g., social life, academics, school activities) and (2) students perceive that peers engage and expect others to join them in engaging in unhealthy behaviors to signal that their priorities are in line with others' (e.g., academic success).

Notably, Trockel, Barnes, and Egget [52] found evidence that contradicts the students' belief that healthful habits, like getting adequate sleep, compromise academic success. They also found that time management skills, such as using a planner to organize time, were positively correlated with higher first year college GPA [52]. Similarly, other researchers have demonstrated the detrimental effects of poor sleep patterns among college students on outcomes including safe driving and performance on cognitive tasks [53, 54]. According to the IBM, perceived norms regarding others' expectations and behaviors have a substantial effect on emerging adults' intentions to perform a behavior [41, 42]. Engaging students in gathering and reviewing data about actual effects of their healthy and unhealthy behaviors may hold the potential to disconfirm social beliefs that healthy lifestyle and academic achievement are incompatible, thereby removing a barrier to improved health behaviors. Along the same lines, the results may also suggest that students' may feel challenged by their academic pursuits and engage in excessive studying. While they may still believe in the social norm that greater academic success is associated with unhealthy behaviors, providing students with coping tools to assist with their overwhelming academic demands may provide a mechanism for increasing health behaviors.

Finally, students expressed a desire both to fit in and to stand out. Students spoke of needing to be social and connected, but also needing to compete with peers on multiple levels. Findings suggest that students may not be intrinsically motivated to attend to even basic, individual health behaviors such as showering and sleeping, particularly if they are perceived as contradicting popular social norms. It is likely that students perceive their college years and their accompanying poor health behaviors as a temporary and transient state, not realizing that bad health habits are prone to persist into later life. Experiencing healthy lifestyle behaviors as a way to become more successful or to connect with others could potentially shift social perceptions in a way that fosters healthier student behaviors. Of course, changing the social and cultural norms of a campus is a daunting undertaking. However, one encouraging note can be found in Stock, Wile, and Kramer's [55] finding that freshmen university students express a strong interest in health-oriented group programs, suggesting that students want to participate in activities they know other students will also attend. The need for any health program to be popular and socially accepted by peers was also highlighted by the current study's participant advice that an app or activity must appear to be widely utilized by students in order to gain campus-wide uptake.

Regarding mobile health, this sample did not report widespread or consistent use of health apps. Most apps reportedly used were of a social nature for the purpose of staying connected with others. Students in this study were clear that an intervention using smartphones would need to be easy to use, not burdensome, have interesting features, and be personalized and relevant. College students in the current study stated that they would uninstall apps that were perceived as too burdensome, not useful, or placing a drain on their batteries or storage capacity. In accord with the theme of burden, students complained specifically about the tedium of tracking food in health apps. As technology advances, more passive, less effortful ways to track dietary intake will presumably become available. Low burden passive tracking is likely to be more appealing to users. It is important to note, though, that it remains unknown whether active self-monitoring is necessary to preserve the behavior change benefits usually produced by self-monitoring. Students did not report any specific barriers regarding their campus environment (except for unhealthy behavioral social norms) nor did they report lack of knowledge about how to be physically active and eat healthfully. Individualized habit reversal and increasing perceived salience of health behaviors could be effective targets for behavior change in this population using the IBM.

Limitations

Recruitment for this study was difficult despite offering refreshments or a meal. Many students expressed being too busy to spare 90–120 min, a sentiment that was also expressed in the focus groups. During the focus groups, we learned that students at this university are often recruited to participate in research, and as such, our meal and refreshment incentives may not have been enticing enough for students to sign up for the study. The small sample is one of the major limitations of this study. There exists the potential for selection bias with

those who volunteered to participate in this study. While saturation was achieved, it is possible that the results reflect only those with selection bias, and the opinions of those who are less willing to participate in research are missing completely. Additionally, more females than males were recruited. However, no apparent gender differences arose within the focus groups. Future qualitative work in this population should consider shortening the sessions by using more focused questions and recruiting in a way to ensure a representative gender distribution. Along the same lines, students may be more willing to participate for incentives that they perceive to be more meaningful.

Additionally, our data were collected from students at one target university to directly inform the development of a future intervention to be implemented in this one specific university. Although the results of this study may not generalize to all other colleges and universities, they may be applicable to other colleges which are comprised primarily of academically elite students. Students in this target population spoke at length about competing with others in many ways and feeling a need to excel both academically and in their future careers. It is likely that other students at top universities in the USA may hold similar beliefs, and while the results may not generalize broadly, they are important to consider for interventions targeting this specific subset of the college student population.

Future Directions

It should be noted that the current study is novel in that it provides information on an understudied, academically elite college population. However, while this sample is at risk for health complications as discussed throughout this paper, this is also a sample of highly educated individuals and thus more advantaged in comparison to other populations. Emerging adults with limited or no access to education make up a higher at-risk population as education is widely known to be correlated with health quality.

A key advantage of mobile health and electronic health promotion and intervention programs is their ability to be disseminated widely. While higher educated and higher income individuals have slightly more ownership of smartphones, over 80% of individuals in the USA with lower education and lower income use smartphones and the internet at least occasionally [34]. Therefore, once effective multiple health behavior change interventions are developed, it is crucial that researchers consider how to maximize their reach to other at-risk populations. Along the same lines, future research should consider strategies to engage populations without access to mobile devices and the internet in these types of health interventions. An appropriate first step in that process is to engage and consult with the target populations (i.e., emerging adults who do not attend college). This paper offers a blueprint for the creation of such a study.

Conclusion

This work highlights unique needs and challenges associated with developing a health promotion intervention for one target college student population using the IBM theoretical framework. Key takeaways are that mobile health interventions must be personalized to participants, low in burden, and have apparent usefulness to the students. Unhealthy living at the expense of academic achievement is regarded as a badge of honor in this target population. Results interpreted according to the IBM indicated that students would be less likely to improve their health behaviors in the face of other academic requirements and perceived social pressures. Thus, devising an intervention that aligns with adding value within the culture of "busyness" appears paramount. Further, students may need education on (1) the importance and consequences of healthy living, since they are living on their own for the first time, (2) habit formation, and (3) self-efficacy building, particularly when faced with other academic and professional opportunities. Integrating personal experiential or normative evidence to dispel misbeliefs about associations between poor health and academic success might favorably influence students' attitudes, agency, and perceived social norms about healthy behaviors. Next steps in this work will be to partner with the students to co-create and develop a mobile health preventive intervention for incoming freshmen.

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Compliance with Ethical Standards

Conflict of Interest All authors declare that they have no conflict of interests.

Ethical Approval All procedures performed in this study were in accordance with the ethical standards of the institutional research committee (our institution's IRB) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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References

1. Afshin A, Forouzanfar MH, Reitsma MB, et al. Health effects of overweight and obesity in 195 countries over 25 years. New Engl J med. 2017;377(1):13–27.

2. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, et al. Executive summary: heart disease and stroke statistics—2015 update. Circulation. 2015;131(4):434–41.
3. Spring B, Moller A, Colangelo L, et al. Healthy lifestyle change and subclinical atherosclerosis in young adults: coronary artery risk development in young adults (CARDIA) study. Circulation. 2014;130(1):10–7.
4. Arnett JJ. Emerging adulthood: a theory of development from the late teens through the twenties. Am Psychol. 2000;55(5):469–80.
5. Vadeboncoeur C, Townsend N, Foster C. A meta-analysis of weight gain in first year university students: is freshman 15 a myth? BMC Obesity. 2015;2(1):22.
6. Ogden CL, Carroll MD, Fakhouri TH, Hales CM, Fryar CD, Li X, et al. Prevalence of obesity among youths by household income and education level of head of household—United States 2011–2014. Morb Mortal Wkly Rep. 2018;67(6):186–9.
7. Centers for Disease Control, National Center for Health Statistics. Nutrition and weight status. Healthy people 2020 midcourse review (chapter 29). 2016. https://www.cdc.gov/nchs/data/hpdata2020/HP2020MCR-C29-NWS.pdf. Accessed 29 Nov 2018.
8. Lloyd-Richardson EE, Bailey S, Fava JL, Wing R. A prospective study of weight gain during the college freshman and sophomore years. Prev Med. 2009;48:256–61.
9. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. Obesity. 2008;16(10):2205–11.
10. American College Health Association. American College Health Association-National College Health Assessment II: Reference Group Executive Summary Spring. Hanover, MD: American College Health Association; 2014.
11. Small M, Bailey-Davis L, Morgan N, Maggs J. Changes in eating and physical activity behaviors across seven semesters of college. Health Educ Behav. 2012;40(4):435–41.
12. Keating XD, Guan J, Piñero JC, Bridges DM. A meta-analysis of college students' physical activity behaviors. J Am Coll Heal. 2005;54(2):116–26.
13. Anderson DA, Shapiro JR, Lundgren JD. The freshman year of college as a critical period for weight gain: an initial evaluation. Eat Behav. 2003;4(4):363–7.
14. Israel TA, King BA, Husten CG, et al. Tobacco product use among adults—United States, 2012–2013. Morb Mortal Wkly Rep. 2004;63(25):542–7.
15. Lenk K, Rode P, Fabian L, Bernat D, Klein E, Forster J. Cigarette use among young adults: comparisons between 2-year college students, 4-year college students, and those not in college. J Am Coll Heal. 2012;60(4):303–8.
16. Patterson F, Lerman C, Kaufmann VG, Neuner GA, Audrain-McGovern J. Cigarette smoking practices among American college students: review and future directions. J Am Coll Heal. 2004;52(5):203–12.
17. Spring B, Moller AC, Coons MJ. Multiple health behaviours: overview and implications. J Public Health. 2012;34(Suppl 1):i3–10.
18. Kang J, Ciecierski CC, Malin EL, Carroll AJ, Gidea M, Craft LL, et al. A latent class analysis of cancer risk behaviors among U.S. college students. Prev Med. 2014;64:121–5.
19. Laska MN, Pasch KE, Lust K, Story M, Ehlinger E. Latent class analysis of lifestyle characteristics and health risk behaviors among college youth. Prev Sci. 2009;10:376–86.
20. Wells K, Makela C, Kennedy C. Co-occurring health-related behavior pairs in college students: insights for prioritized and targeted interventions. Am J Health Educ. 2014;45:210–8.
21. Loef M, Walach H. The combined effects of healthy lifestyle behaviors on all cause mortality: a systematic review and meta-analysis. Prev Med. 2012;55:163–70.
22. Prochaska JJ, Prochaska JO. A review of multiple health behavior change interventions for primary prevention. Am J Lifestyle Med. 2011;5:208–21.
23. American Heart Association. 2013 Statistical fact sheet: 2020 impact goal. Dallas TX: American Heart Association; 2013. Available from: http://www.heart.org/idc/groups/heartpublic/@wcm/@sop/@smd/documents/downloadable/ucm_319831.pdf. Accessed 29 Nov 2018.
24. American Heart Association. My Life Check – Life's Simple 7. http://www.heart.org/HEARTORG/Conditions/My-Life-Check%2D%2D-Lifes-Simple-7_UCM_471453_Article.jsp#.W0kDx9VKhph. Accessed 17 July 2018.
25. Laitinen TT, Pahkala K, Magnussen CG, Viikari JSA, Oikonen M, Taittonen L, et al. Ideal cardiovascular health in childhood and cardiometabolic outcomes in adulthood. Circulation. 2012;125(16):1971–8.
26. Lloyd-Jones DM. The impact of traditional risk factor development on the life course of cardiovascular diseases. Ethn Dis. 2012;22(3 (Suppl 1)):1–30.
27. Brown DM, Bray SR, Beatty KR, Kwan MY. Healthy active living: a residence community–based intervention to increase physical activity and healthy eating during the transition to first-year university. J Am Coll Heal. 2014;62(4):234–42.
28. Napolitano MA, Hayes S, Bennett GG, Ives AK, Foster GD. Using Facebook and text messaging to deliver a weight loss program to college students. Obesity. 2013;21(1):25–31.
29. Plotnikoff RC, Costigan SA, Williams RL, Hutchesson MJ, Kennedy SG, Robards SL, et al. Effectiveness of interventions targeting physical activity, nutrition and healthy weight for university and college students: a systematic review and meta-analysis. Int J Behav Nutr Phy. 2015;12(1):45.
30. Simmons VN, Heckman BW, Fink AC, Small BJ, Brandon TH. Efficacy of an experiential, dissonance-based smoking intervention for college students delivered via the internet. J Consult Clin Psychol. 2013;81(5):810–20.
31. Harrison MA, Bealing CE, Salley JM. 2 TXT or not 2 TXT: college students' reports of when text messaging is social breach. Soc Sci J. 2015;52(2):188–94.
32. Harrison MA, Gilmore AL. U txt WHEN? College students' social contexts of text messaging. Soc Sci J. 2012;49(4):513–8.
33. Pew Research Center (2018) Mobile fact sheet. http://www.pewinternet.org/fact-sheet/mobile/. Accessed 13 July 2018.
34. Poushter J Smartphone ownership and internet usage continues to climb in emerging economies. Pew Research Center 2016;22:1–44.
35. Brown ON, O'Connor LE, Savaiano D. Mobile MyPlate: a pilot study using text messaging to provide nutrition education and promote better dietary choices in college students. J Am Coll Heal. 2014;62(5):320–7.
36. Patrick K, Marshall SJ, Davila EP, Kolodziejczyk JK, Fowler JH, Calfas KJ, et al. Design and implementation of a randomized controlled social and mobile weight loss trial for young adults (project SMART). Contemp Clin Trials. 2014;37(1):10–8.
37. Riley W, Obermayer J, Jean-Mary J. Internet and mobile phone text messaging intervention for college smokers. J Am Coll Heal. 2008;57(2):245–8.
38. Fishbein M. The role of theory in HIV prevention. AIDS Care. 2010;12(3):273–8.
39. Fishbein M, Cappella JN. The role of theory in developing effective health communications. J Commun. 2006;56:S1–S17.
40. Montaño DE, Kasprzyk D. Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. In: Glanz K, Rimer BK, Viswanath K, editors. Health behavior and health education: theory, research, and practice. San Francisco, CA: John Wiley & Sons; 2008. p. 67–121.
41. Brown B. Adolescents' relationships with peers. In: Lerner R, Steinberg L, editors. Handbook of adolescent psychology. 2nd ed. New York, NY: Wiley; 2004. p. 363–94.

42. Gardner M, Steinberg L. Peer influence on risk taking, risk preference, and risky decision making in adolescence and adulthood: an experimental study. Dev Psychol. 2005;41:625–35.
43. LaCaille LJ, Dauner KN, Krambeer RJ, Pedersen J. Psychosocial and environmental determinants of eating behaviors, physical activity, and weight change among college students: a qualitative analysis. J Am Coll Heal. 2011;59(6):531–8.
44. Klasnja P, Hekler EB, Shiffman S, Boruvka A, Almirall D, Tewari A, et al. Microrandomized trials: an experimental design for developing just-in-time adaptive interventions. Health Psychol. 2015;34(S):1220–8.
45. Patton MQ. Qualitative research and evaluation methods. New York, New Delhi, London: Thousand Oaks Sage Publications; 2002.
46. Ulin PR, Robinson ET, Tolley EE. Qual Meth Pub Health. San Francisco, CA: Jossey-Bass; 2005.
47. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3(2):77–101.
48. NVivo qualitative data analysis Software; QSR International Pty Ltd. Version 10, 2012.
49. Onwuegbuzie AJ, Dickinson WB, Leech NL, Zoran AG. A qualitative framework for collecting and analyzing data in focus group research. Int J Qual Methods. 2009;8(3):1–21.
50. Goldstein CM, Xie SS, Hawkins MA, Hughes JW. Reducing risk for cardiovascular disease: negative health behaviors in college students. Emerg Adulthood. 62(5):320–7.
51. Leshed G, Sengers P. I lie to myself that I have freedom in my own schedule: productivity tools and experiences of busyness. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 905–914): ACM; 2011.
52. Trockel MT, Barnes MD, Egget DL. Health-related variables and academic performance among first-year college students: implications for sleep and other behaviors. J Am Coll Heal. 2000;49(3):125–31.
53. Lindsay GA, Hanks WA, Hurley RD, Dane S. Descriptive epidemiology of dozing and driving in a college student population. J Am Coll Heal. 1999;47(4):157–62.
54. Pilcher JJ, Walters AS. How sleep deprivation affects psychological variables related to college students' cognitive performance. J Am Coll Heal. 1997;46(3):121–6.
55. Stock C, Wille L, Krämer A. Gender-specific health behaviors of German university students predict the interest in campus health promotion. Health Promot Int. 2001;16(2):145–54.