

Perceptions and motivations:
An exploration of diet and fitness app use among college students

Strategic Communication M.A. Capstone

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About the Author

Melissa Rossi is a graduate of the Strategic Communication M.A. program at the University of Minnesota. In addition to having 8 years of experience in B2C marketing-communications, Melissa has an interest in how technology can be used to influence individual decision-making and behaviors, specifically in the realm of health.

In her free time, she enjoys yoga, running, barre, and high-intensity-interval-training. Additionally, she has a passion for women's health and enjoys volunteering with Planned Parenthood, which she has done since 2009.

This project is dedicated to...

Cohort 11, for providing a "safe space" for growth, encouragement, companionship, deep breaths, standing tall, power posing, laughs, and dollar-dollar-dollar.

Alfred the cat, for his unconditional love, 4:45 a.m. wake-up paws, and hard work and dedication in co-authoring this paper.

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EXECUTIVE SUMMARY

This study explored perceptions of diet and fitness apps among users and non-users using the Theory of Reasoned Action and Uses & Gratifications Theory as a framework. It built upon prior studies which investigated general use of smartphone and mHealth apps as well as motivations for continued use of diet and fitness apps, which could be especially useful for promoting and managing health among Millennials, also known as digital natives, who are accustomed to using technology in various aspects of their lives.

While prior studies focused on who is using mHealth apps, how those users are using mHealth apps, and what factors influence continued use of an mHealth app, there was no research at the time of this study that identified what factors might influence an individual to start use of an mHealth app. This study sought to both identify those factors and to further research on what factors influence continued use of an mHealth app.

To identify factors that would influence use of an mHealth app (specifically diet and fitness apps), a belief elicitation study was conducted among undergraduate college students in the School of Journalism at the University of Minnesota. Participants were also asked to report their use (or non-use) of mHealth apps; those participants who were classified as "users" were asked additional questions about factors which could influence their use or continued use of a diet or fitness app. A total of 289 responses were collected; of those responses, 215 were classified as users and 74 were classified as non-users.

Popular reasons for use included goal setting and tracking of health behaviors. It's recommended that these be included as primary features in future app development. Notifications and feedback systems were also valued features, and there are opportunities for more research about rewards for health behaviors, as opinions about use of rewards (intrinsic and extrinsic) varied among participants. Additionally, further

research should be conducted to investigate how to inspire non-motivated students to engage in healthy behaviors, perhaps through apps that don't explicitly promote activity, such as Pokémon Go.

The most outstanding finding of this study was the perception among both users and non-users that use of diet or fitness apps could lead to obsessive behaviors and disordered eating-- the antithesis of what an mHealth app should promote. Further research should be conducted to investigate these potential outcomes in current or past app users and if there are elements within apps or personality factors in humans that could predict when or how app use could lead to unhealthy outcomes. App developers should also be cognizant of these potential outcomes as they create new technologies.

INTRODUCTION

Mobile health application (or mHealth app) use has grown exponentially over the past few years, and that growth is likely to continue -- the industry was estimated to be valued at \$13B in 2016, with a projected growth to \$31B by 2020 (Research2Guidance, 2016). mHealth apps have been defined as applications through which patients or users can access health information online (Lee & Cho, 2016) and that are "listed in the medical and health & fitness app category of the app store from Apple, Google, Amazon and BlackBerry" (Research2Guidance, p. 8, 2016). They encompass a variety of health-related services such as chronic disease symptom management, pharmaceutical drug organizers, healthcare record management, and diet and fitness trackers. By July of 2016, 259,000 mobile health applications had been developed and added to the app market, accounting for 3.2 billion downloads by users (Research2Guidance, 2016). Notably, diet and fitness trackers have been reported by users as the type of mHealth app most frequently downloaded (Krebs & Duncan, 2015); these apps will be the focus of this report.

In 2012, 19% of smartphone users reported downloading an mHealth application, out of which "38%...track their exercise, 31% monitor their diet, and 12% use an app to manage their weight" (Fox & Duggan, p. 13, 2012). Only two years later, Google declared 2014 the year of the Health and Fitness app due to the dramatic increase in downloads in this category during that year (Boxall, 2014). By 2015, it was estimated that 58% of smartphone users had reported using an mHealth app, specifically related to diet or fitness (Krebs & Duncan, 2015). Despite the growing popularity of diet and fitness apps, the jury is still out on whether they are an effective means to weight loss, achieving fitness goals, or simply general management of an individual's health and wellness.

Empirical studies have yet to demonstrate the effectiveness of using diet and fitness apps. A nutrition app developed by health professionals, known as My Meal

Mate, proved effective in helping study participants who used the app with regularity lose weight (Carter, Burley, & Cade, 2017). Additionally, a study which utilized other digital channels like social media showed promise in helping college students to prevent weight gain (West et al., 2016). However, systematic reviews of diet or fitness health app interventions (including MyFitnessPal, a popular app now owned by Under Armour that is based on Social Cognitive Theory) showed mixed results (Zhao, J., Freeman, B., & Li, 2016; Schoeppe et al., 2016). Additionally, content analyses reviewing popular apps for adherence to public health physical activity requirements (Knight, Stuckey, Prapavessis, & Petrella, 2015) and evidence-based behavior change principles (Cowan et al., 2013) exposed the lack of theory behind the design of many apps. This is likely due to the fact that many mHealth apps on the market are being developed by companies in tech or telecommunications rather than in healthcare (Research2Guidance, 2016), meaning evidence-based behavior change models may not be used when designing and developing apps that promise to do just that -- change behavior. Health researchers have noted that apps demand more thorough development and review before being deemed effective.

Despite the drawbacks of health apps currently on the market, health professionals and educators have also acknowledged the ubiquity of mobile technology and health apps, and that they could have an important place in educational settings or in mass health interventions (Cumiskey, 2011; Kratzke, 2012; Eapen & Peterson, 2015). One area of interest among researchers is use of health apps among college students.

College students and diet + fitness apps

While anyone with access to an app-enabled smartphone can be a user of an mHealth app, younger, educated adults are more likely to own a smartphone, to search for health information online (Fox & Duggan, 2012) and to use mHealth apps (Krebs & Duncan, 2015; Cho, Park, & Lee, 2014). This is understandable, given that they are digital

natives -- they have grown up using the internet and digital technology for a variety of purposes.

College students in particular could benefit from use of a diet or fitness app for either weight management or lifestyle maintenance. College is potentially the first time that students are independent and managing their own schedules, including meals and exercise habits, so tracking or promoting these behaviors through a smartphone app could prove useful. This is especially important because weight gain (commonly known as the Freshman 15) (Sparling, 2007) is a common concern among college healthcare administrators, and rightfully so. Between 2011- 2014, 17% of children under the age of 19 were considered obese; that prevalence jumps to 32.3% for adults aged 20-39 ("Childhood Obesity Facts," n.d.). As for college students in particular, a national survey found that over one-third (36.6%) are considered overweight or obese, only 44% report exercising enough to meet recommended physical activity standards, and 63% report only eating 1-2 servings of fruits or vegetables per day (*National College Health Assessment: Undergraduate Student Reference Group, Executive Summary, Fall 2016, 2016*).

Likewise, mental health is another concern among college healthcare administrators. As of 2016, 30% of college students report being diagnosed with at least one mental health condition, 52.7% "felt things were hopeless" within the last 12 months, 87.3% "felt overwhelmed by all [they] had to do" in the last twelve months, and 61.9% "felt overwhelming anxiety" within the last twelve months (*National College Health Assessment: Undergraduate Student Reference Group, Executive Summary, Fall 2016, p. 13-14, 2016*). How can we help them? Lifestyle habits like healthy eating and regular exercise are recommended as a cost-effective and accessible way to prevent or manage the physical, mental and emotional challenges that college students face (Sharma, Madaan, & Petty, 2006).

Because 86% of college students have a smartphone (Harris, 2013), diet and fitness apps could be a way to help a significant portion of the college student population manage their physical and mental health. Since engagement with a diet or fitness app requires students to self-select or opt-in to using an app, it's vital to understand college students' motivations for downloading and using an mHealth application.

Motivational factors for mHealth app use

It's difficult to guess why exactly an individual would be motivated to use a diet or fitness app. The industry is competitive, so app developers aren't necessarily publishing their market research or subscriber data for public viewing. Additionally, it's difficult for academia to keep up with studying the fast-paced changes that digital technology affords. Here is what we know: on the surface, users of health apps reported downloading apps to track physical activity, track their diet, to lose weight and to gather information about exercises (Krebs & Duncan, 2015). Using the Technology Adoption Model (TAM), it was found that perceived ease of use (PEOU) did not affect intention to use a health app (Cho, Quinlan, et al., 2014; Cho, Lee, Kim, & Park, 2015). Perceived usefulness (PU) of health apps was low with users with a high health consciousness and high eHealth literacy; it was conjectured that this may be due to people with high health consciousness either already devoting other resources (such as time or money) to health behaviors or that they perceive health behaviors to be so integrated into their lives that an app is not necessary to manage these behaviors (Cho, Quinlan, et al., 2014). This aligns with an earlier health intervention study that found that people with low health-status but high health-motivation resulted in adoption of more healthy behaviors than people with high health-status and high-health motivation (Moorman, et al., 1993). On a related note, people who put effort into their fitness regimens but evaluated themselves poorly in terms of appearance and fitness abilities were more likely to see diet and fitness apps as useful (Cho et al., 2015) and that people who were health conscious were

more likely than people who were not health conscious to use a fitness app (Cho, Park, et al., 2014). So, individuals who are interested in taking care of their health but who don't necessarily perceive themselves as athletic or fitness gurus are a potential target market. That being said, it's still unclear what exactly drives these individuals to start using a diet or fitness app. This study will be an exploration into perceptions about diet and fitness apps and the motivations behind use of a diet or fitness app.

LITERATURE REVIEW

Most of the existing research on user motivations and intentions to use a diet or fitness app has used the Technology Adoption Model (TAM), a variation of the Theory of Reasoned Action (TRA), which focuses on perceived use and perceived ease of use of a technology. This is understandable, given that before health apps, people engaged in health interventions could simply record their food intake or exercise activity with paper and pen or on a computer. It's easy to see how the technological advancement in recording or tracking behavior could be the primary variable of interest. However, that reasoning doesn't account for the social influences that digital technology now affords. Networkability (using health apps to connect to other users) was shown to be a motivating factor for intended continued use of a diet or fitness app (using a Uses and Gratifications approach) (Lee & Cho, 2016). Perhaps social connections also influence initial use of diet and fitness apps. In order to explore this, as well as other potential unknown motivating factors that could both encourage or prevent diet and fitness app use, it is proposed that the TRA be used to assess college student beliefs and attitudes about diet and fitness apps.

Theory of Reasoned Action

In his book *Dynamics of Persuasion*, researcher and author Richard Perloff describes the Theory of Reasoned Action as "the most systematic explanation in the field of the processes by which beliefs influence behavior. It offers a roadmap for the journey that thoughts in a person's head must travel before they can affect the actions he or she performs. In so doing, it generates a series of specific strategies that persuaders should employ to craft communications on any topic you can imagine" (2014, p. 134). Since the first goal of this research is to establish why college students might choose to engage in the behavior of using a diet or fitness app, and because of the TRA's systematic

approach to establishing the motivations behind behavior, it will serve as the framework for answering this question.

Reasoned Action Theory was originally developed by Martin Fishbein and Icek Ajzen in 1975 as a theory to explain the effects of attitudes and beliefs on behavior. Fishbein and Ajzen noted that across different fields and industries, prior research varied drastically in defining the concept of attitude, thus they provided a framework: "attitude is learned...it predisposes action, and such actions are consistently favorable or unfavorable toward [an] object" (Fishbein & Ajzen, p. 6, 1975). Beliefs, on the other hand, "represent the information [a person] has about the object...specifically, a belief links an object to some attribute" (Fishbein & Ajzen, p. 12, 1975). Related to beliefs is the notion of behavioral intention, which in essence, is a belief about oneself and the types of behaviors one performs (Fishbein & Ajzen, 1975). The last piece of the original puzzle was overt behavior, or "observable acts of the subject" ((Fishbein & Ajzen, p. 13, 1975). After Ajzen's continued research on behavior, TRA was updated in 2010 to include the notion of perceived behavioral control. Again, Perloff provides a clear and concise summary of the components of Reasoned Action Theory:

"There are five components of the theory: *attitude toward the behavior*, the individual's judgment that performing the action is good or bad; *perceived norm*, perceived social pressure to perform the action; *perceived behavioral control*, the degree to which individuals believe they are capable of performing a particular behavior, *behavioral intention*, the intent or plan to perform a particular behavior, and *behavior* itself, the action in a particular situation" (p. 136).

Each of the components mentioned above is explored in further detail in the paragraphs that follow.

Again, attitude is defined as "a latent disposition or tendency to respond with some degree of favorableness or unfavorableness to a psychological object" (Fishbein & Ajzen, p. 76, 2010). Attitude is typically measured on bipolar scales to measure the

degree of favorability (or unfavorability) a person has toward the construct being tested. Additionally, attitude "consists of two subcomponents: behavior beliefs (beliefs about consequences of the behavior) and outcome evaluations (evaluations of the consequences)" (Perloff, 2014, p. 136). It was found that if individuals have positive attitudes toward mHealth apps (medical apps as opposed to health and fitness apps), that use of apps was more likely to occur (Zhang, Guo, Lai, Guo, & Li, 2014), but no information was found at the time of this study about beliefs or attitudes about diet or fitness apps.

Perceived norms, the "perceived social pressure to perform the action" (Perloff, 2014, p.136), also has two subcomponents, which in turn have two subcomponents. The first subcomponent is injunctive norms, which consist of "injunctive normative beliefs, or beliefs that individuals who are important to endorse the behavior," and the motivation to comply, which refers to how influential those individuals are on the person conducting the behavior (Perloff, 2014, p. 138). The second subcomponent is descriptive norms, which consist of descriptive normative beliefs, which are beliefs about the influential individuals' frequency of engagement in the behavior, and identification, which is how much the subject identifies with those influential individuals (Perloff, 2014, p. 138). While research has shown that app users learned about apps through friends and family, a physician, a web search, or by searching the app store (Krebs & Duncan, 2015), the degree to which each of these sources influenced or motivated users to download and use an app was not investigated. Additionally, networkability, or being able to connect with other users socially through an app, was an indicator for continued use of a diet or fitness app (Lee & Cho, 2016); however, no research was found at the time of this study that explored the degree of influence the people within these social networks (face to face or digital) had on users.

Perceived behavioral control, or "the degree to which individuals believe they are capable of performing a behavior," (Perloff, 2014, p. 136) considers the variable of self-

efficacy. Despite positive feelings toward a behavior, elements such as addiction or lack of self-confidence could prevent an individual from performing a desired behavior (Perloff, 2014). No information was found at the time of this study that directly addressed perceived behavioral control regarding mHealth apps. Perceived ease of use could be a related factor, but that was found to have no effect on use (Cho, Park, et al., 2014; Cho, Quinlan, et al., 2014; Lee & Cho, 2016), likely because the subjects of the studies were digital natives and adept at using technology.

Finally, behavioral intention is the plan to engage in the behavior in question (Perloff, 2014). It is an "estimate of the likelihood or perceived probability of performing a given behavior [and it is expected that] the higher this subjective probability, the more likely it is that the behavior will in fact be performed" (Fishbein & Azjen, p. 39, 2010). Most of the research currently available on use of mHealth apps is closely related to this category. Again, the research conducted thus far still raises questions. Cho, Quinlan, et al. (2014) found that people with high health consciousness and high health motivation didn't see apps as necessary to manage their health behaviors, but people with low health consciousness and high motivation were more likely to use mHealth apps. Thus, the drivers behind intention to use are still a mystery!

While TRA is widely used in health behavior research, including assessing college student attitudes, beliefs and behaviors around diet or exercise, or engagement in diet and exercise programs (including those involving digital or computerized media), no research specifically using TRA to explain the motivations behind an individual's decision making about using diet or fitness mHealth applications was found during the time of this study. Because information is lacking, the purpose of this report is to conduct a belief elicitation study to assess college student beliefs about diet and fitness app use. This information can be used to gain a better understanding of college student beliefs around diet and fitness apps and to provide a structure for future research on attitudes.

RQ 1: What beliefs and attitudes do college students hold toward diet and fitness apps and use of those apps?

Uses and Gratifications

Interesting research has been conducted using a Uses & Gratifications framework to investigate the gratifications, motivations and use intentions of users of diet and fitness apps. This work could provide additional insight into the benefits of using a diet or fitness app and potential motivations for use or continued use.

The Uses and Gratifications Theory was developed by Elihu Katz and Michael Gurevitch in the 1970s to explain why people use different forms of media. In the original study, published in 1973, Katz and Gurevitch assessed how people used popular media of the time (television, radio, newspaper, books and film) and found five categories of gratifications emerge: cognitive needs (those "related to strengthening information, knowledge and understanding), affective needs (those pertaining to "strengthening aesthetic, pleasurable and emotional experience"), integrative needs ("needs related to credibility, confidence, stability, and status"), needs performing an integrated function (those "related to strengthening contact with family, friends, and the world), and escapist needs (which "weaken contact with self and one's social roles" and serve as a form of tension release) (Katz & Gurevitch, 1973, p. 166-167). Additionally, at the time of the original research, mass media was found to have less ability to fulfill personal needs such as "personal confidence and security" than face-to-face contact with friends.

Contemporary Uses and Gratifications research acknowledges not only the shift to new forms of digital media, but also the implications of this change, such as the shift of media consumers to media users, the affordance of user generated content, media convergence, and social affordances provided by new media. These shifts come with their own set of gratifications, such as "content gratifications," "process gratifications," (Rubin, 2009) and gratifications "related to the use of media as a social environment"

(Sundar & Limperos, 2013, p. 509). Sundar and Limperos point out that the emergence of new media and its ever-evolving capabilities makes it difficult to establish if users engage with certain media in order to fulfill a need (gratification sought), or if the need is created by engagement with a medium (gratification obtained) (2013). An example of this can be found in a study conducted by Joo & Sang (2013), which found that smartphone users were motivated by both ritualized use (escapism, relaxation) and instrumental use (information gathering, goal-setting, etc.) upon use of their devices, however the original purchase motivator of a smartphone was for instrumental use. Likewise, users of smartphone apps were found to value the entertainment function of the apps and to prefer using their phones to "relax and relieve stress" rather than to search for information (Ho & Syu, p. 319, 2010).

Uses and Gratifications research specific to mHealth apps is emerging. Notable for the present study, Lee & Cho (2016) measured obtained uses of diet and fitness apps and users' intention to continue use of the apps. The motivations measured were recordability ("the extent to which a user perceives that he or she can record the history of the diet and fitness"); networkability ("the extent to which one perceives he or she can share diet and fitness information and personal activity history with other users through the apps"); credibility, accuracy and comprehensibility of the information provided in the app; entertainment ("the degree of fun one experienced through use of the diet or fitness app"); and trendiness ("how fashionable one perceives his or her use of the apps is") (Lee & Cho, 2016, p. 3-5). Through review of previous research, the authors found that recordability, networkability and information quality (credibility, accuracy and comprehensibility) were common media-oriented motivators, or motivators that are a result of the functionality of the apps (Lee & Cho, 2016). Trendiness and entertainment were user-oriented motives of interest.

Recordability, networkability, credibility, comprehensibility and trendiness were found to have a positive effect on intention to continue use of the app; entertainment had

no effect on intention to continue use, counter to prior research on general smartphone app use, nor did accuracy of information (Lee & Cho, 2016). Additionally, Lee & Cho recognized "the high level of gamification in health apps" found by Lister, et al., and associated this concept to the entertainment gratification (Lee & Cho, 2016, p. 4; Lister, West, Cannon, Sax, & Brodegard, 2014). However, game designer and researcher Jane McGonigal notes that while games can provide a sense of fun or entertainment, it's actually because they give players a sense of fulfillment through work, or as she puts it, "games make us happy because they are hard work we choose for ourselves." (McGonigal, 2011, p. 28). She states that, while games have multiple elements that contribute to their makeup and success, "all games share four defining traits: a goal, rules, a feedback system, and voluntary participation" (McGonigal, 2011, p. 21). These elements are often part of smartphone apps from all genres, and researching user perceptions about them could provide further insight into user motivations, gratifications and intentions for use. Voluntary participation is essentially the topic at hand-- why would someone voluntarily participate in using a diet or fitness app? It would be difficult to measure general user perceptions on rules given the variety of apps and rule systems that could exist; however, goals and feedback systems are often desired functions of diet and fitness apps (Krebs & Duncan, 2015; Rabin & Bock, 2011), and their addition to the study would pair nicely with the gratification of recordability. Descriptions of the gratifications or reasons for use that will be explored in this study are listed below.

Recordability

Again, recordability is defined as "the need to keep a record of one's dietary or fitness activities" (Lee & Cho, p. 3, 2016). As noted by Lee & Cho, "For successful diet/fitness results, the routinization and habituation of activities is fundamental— a process that regular record-keeping can effectively assist" (p. 3, 2016). Because recordability has already been found as an element of diet and fitness apps that is

related to intention to continue use, it may also be a motivator for initial use, or a sought gratification.

Networkability

Lee & Cho defined networkability as "the enabling of communication and interaction for and among users" (2016, p. 3). Like recordability, it was found to be an aspect of apps that is appealing to users and affects intention to continue use. It has yet to be explored, though, if users perceive networkability to be an initial motivator for using a diet or fitness app.

Trendiness

The final variable studied by Lee & Cho that impacted intention to use that was trendiness, defined as popularity, or "how the use of such technology will be perceived by others" (Lee & Cho, 2016, p. 4). Interestingly, this (and perhaps networkability) could also provide a clue about perceived norms regarding use of a diet or fitness app. Prior research found that trendiness was a motivator for use of smartphone apps in general (Ho & Syu, 2010), however it was unclear if trendiness was a "gratification sought" or a "gratification obtained" (Ho & Syu, 2010). This study will continue to explore trendiness as a potential motivator for use.

Goal-setting

McGonigal states that in games, goals "provide players with a sense of purpose" (McGonigal, 2011, p. 21). It makes sense, then, that goal-setting would be a reason for use of a diet or fitness app -- a user would have a goal, and the app would be a tool to help them to achieve that goal. Goal-setting features were identified as a desirable feature of mHealth fitness apps (Rabin & Bock, 2011), but it has yet to be determined if goal-setting is a primary reason for use.

Notifications + Feedback

In a game, a feedback system "tells players how close they are to achieving the goal...[and] real-time feedback serves as a promise to the players that the goal is definitely achievable, and it provides motivation to keep playing" (McGonigal, 2011, p. 21). In apps, like games, "it can take the form of points, levels, a score or a progress bar" (McGonigal, 2011, p. 21), but since diet and fitness apps rely on "real-life" behaviors to earn points on-screen, notifications and reminders must be considered in addition to in-app progress reports. Research performed by Krebs & Duncan reveals that users or potential users value these types of systems for motivation and encouragement (2015).

Rewards

McGonigal notes that feedback systems within games can include points and levels, however, with an app, where the action or behavior of the "game" occurs in real-life versus on-screen, it seems natural that the points should as well. Many companies certainly think so. Under Armour, now owner of MyFitnessPal, sends users coupons for discounts on their athletic gear for logging into the app. Other apps provide coupons for "healthy" partners like juice and smoothie shops for goal achievement or use. And the groundwork for health insurance benefits has already been set through fitness reimbursement programs with gyms and fitness studios. It's unclear how many apps use "real-life" incentives to reward their users at this time, if those rewards come as a result of logging in or for achieving goals, and if these incentives actually keep users motivated.

Whether gamification elements in health apps can effectively change behaviors has yet to be determined (Lister et al., 2014; Alahäivälä & Oinas-Kukkonen, 2015; Zuckerman & Gal-Oz, 2014). This study will continue the exploration of recordability, networkability and trendiness as gratifications for use of diet and fitness apps, and will

also consider other potential gratifications: goal-setting, notifications or feedback (the elements of gamification identified by McGonigal), and rewards.

RQ2: What gratifications motivate college student use of diet and fitness apps?

METHOD

To understand what factors may influence college student use of a diet or fitness app, and what gratifications users seek and receive from use of an app, a qualitative and quantitative survey (Appendix I) was distributed to a convenience sample of undergraduate students in the University of Minnesota School of Journalism through the Student Subject Pool between April 24, 2017 and May 5, 2017. In exchange for participating, students received extra credit points in their School of Journalism classes.

Procedure

The survey was divided into three sections: part one identified usage patterns among participants, part two contained belief elicitation questions based upon those created by Fishbein & Ajzen (2010), and part three (distributed only to participants who identified as users in part one) contained an assessment of uses and gratifications based upon the survey distributed by Lee & Cho (2016). Part two, and three questions in part three, consisted of qualitative prompts which were coded by the author of this study. Coding of the belief elicitation responses was based upon the gratifications identified by Lee & Cho (2016) as well as trends found in participant answers.

Measurement

In the quantitative survey questions in part three, a five-point Likert scale was used to measure degrees of agreement with the prompt, with 1 representing "strongly disagree" and 5 representing "strongly agree," as shown in Appendix I.

RESULTS

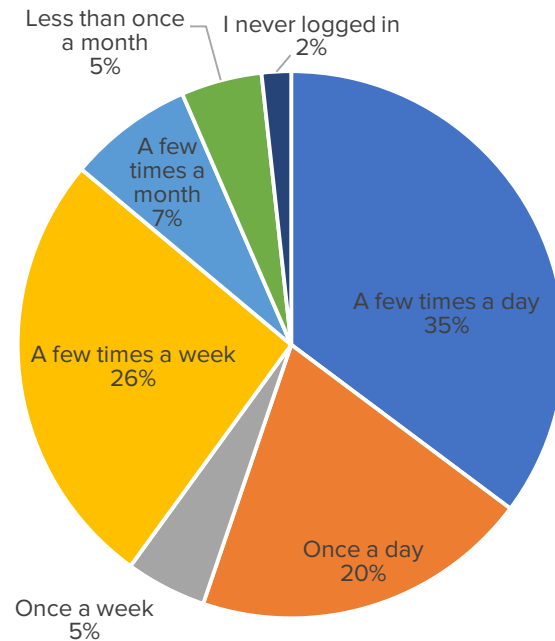
Participants

Eligibility to complete the survey was based upon the question, "Do you own a smartphone?" After filtering for duplicates, 289 usable responses were collected. Of those responses, 82.4% were female and 71.7% were white. The average age was 20.1.

Overall, participant use of diet and fitness apps was high. Out of the 289 participants, 21.8% reported having downloaded a diet-only app, 37% reported downloading a fitness-only app, and 50.1% reported downloading an app that tracks both diet and fitness; 26.7% of participants reported downloading two or more types of apps, and 11.7% of those participants who had downloaded two or more types of apps reported downloading all three types of apps. Of the 289 participants, 19% stated they had never downloaded a diet or fitness app. Out of the participants who had reported downloading at least one type of app (n=289), 35% reported logging in a few times a day, 20% reported logging in once a day, 26% reported logging in a few times a week, 5% reported logging in once a week, 7% logged in a few times a month, 5% logged in less than once a month, and 2% never logged in.

Based upon responses to the questions "Have you ever downloaded any of the following apps on your smartphone? If so, check all that apply, " and "During your time of peak usage, how often did you log into the diet or fitness app that you downloaded?", 25.5% were deemed "non-users" and 74.5% were deemed "users"; 40% of participants who downloaded at least one app had logged in within the last 30 days; of these users, 86% reported logging in more than a few times per week. These participants (n=80) were classified as "active users."

Diet and Fitness App User Login Frequency at Time of Peak Use



n=289

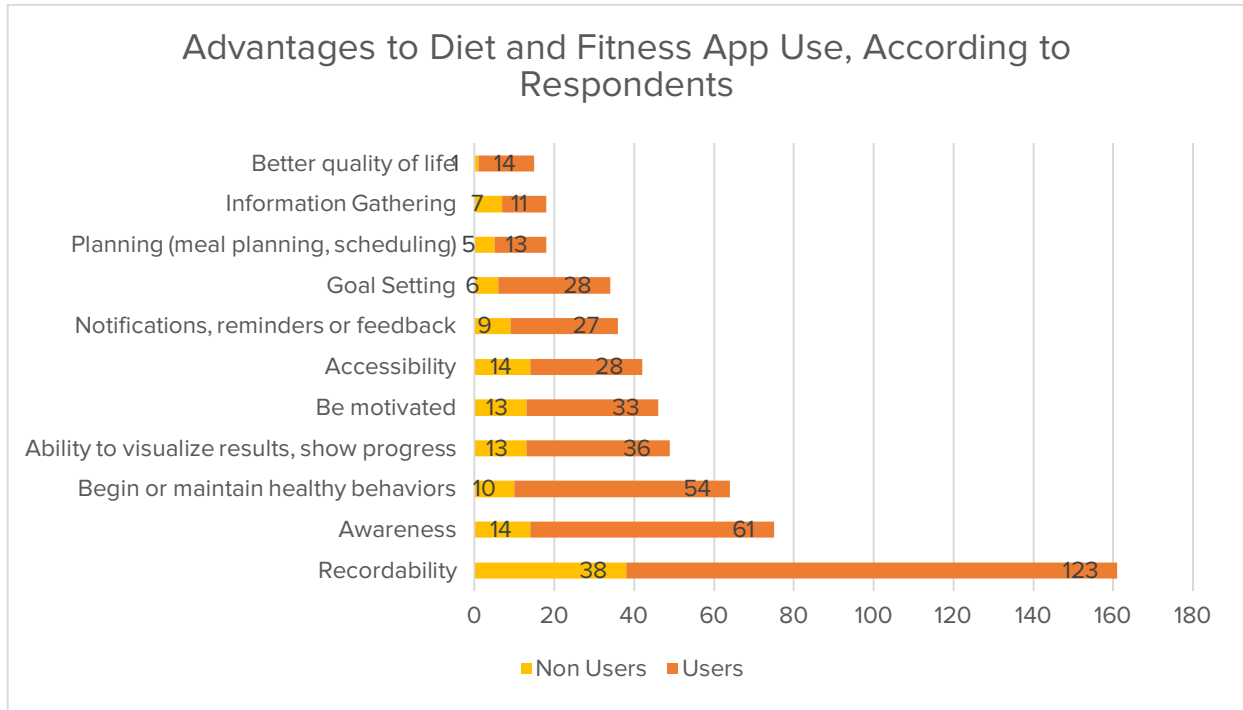
The paragraphs that follow outline participant responses to parts two and three of the survey, which answer research questions 1 and 2, respectively.

RQ 1: What is the relationship between college student beliefs and attitudes toward diet and fitness apps and use of those apps?

Advantages + Disadvantages to Use

Users and non-users listed a variety of advantages to use; the primary similarity between the two groups was the advantage of recordability (55.3% total, n=289). On a similar note, 17.6% of non-users (n=74) and 16.7% of users (n=215) thought the ability to visualize results and to show progress was an advantage. Awareness was another popular theme (25.9% of total, n=289). The advantage of building or maintaining healthy

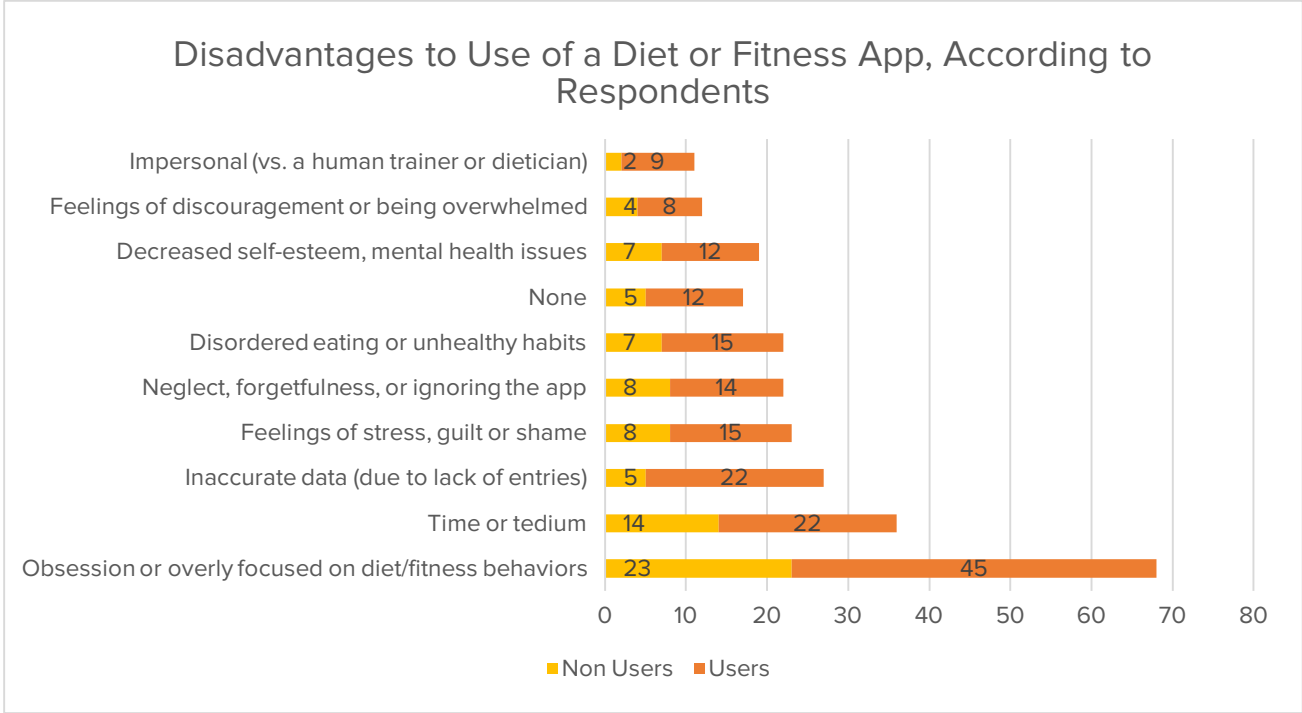
behaviors was another common advantage listed among users (25%, n=216). Finally, goal setting (11.8%, n=289) and notifications (12.5%, n=289) were popular advantages to use among all participants.



n=289

Strikingly, the biggest disadvantage listed by both users and non-users was "obsession" or "obsessive" behaviors due to using a diet or fitness app (23.5% total, n=289). It wasn't always clear whether participants were referring to becoming obsessed with the technology itself or obsessed with their eating or exercise habits, however 7.6% of total users explicitly noted eating disorders or unhealthy eating or exercising behaviors as disadvantages to use, and 6.6% of total participants reported feelings of decreased self-esteem, feelings of self-consciousness, mental health issues or body image issues as disadvantages to use. Interestingly, a higher percentage of non-users than users noted feelings of stress, guilt or shame (10.8% vs. 6.9%) or comparing oneself

to others (4.1% vs. 0.5%) as disadvantages to use. The next most common disadvantage brought up by both users and non-users was the time and tedium of interacting with an app and entering data (12.4% total, n=289; 26.3% of active users, n=80).



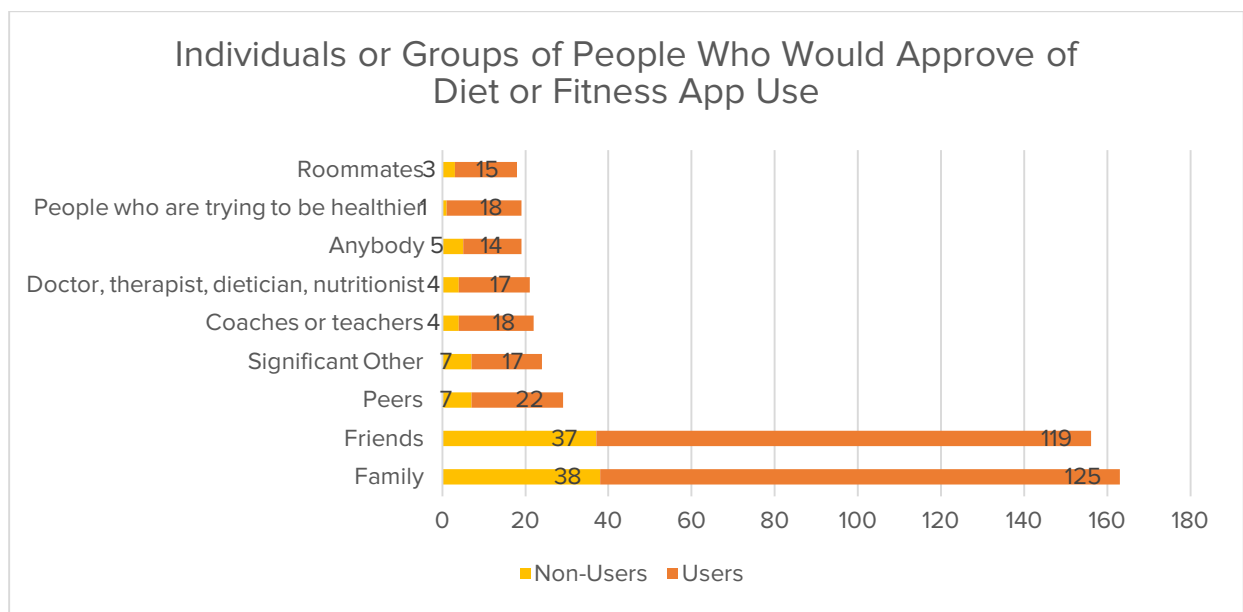
n=289

Disparities in Disadvantages to Use	Non Users	% (n=74)	Users	% (n=215)	Total	% (n=289)
Obsession or overly focused on diet/fitness behaviors	23	31.08%	45	20.83%	68	23.45%
Time or tedium	14	18.92%	22	10.19%	36	12.41%
Feelings of stress, guilt or shame	8	10.81%	15	6.94%	23	7.93%
Disordered eating or unhealthy habits	7	9.46%	15	6.94%	22	7.59%
Decreased self-esteem, mental health issues	7	9.46%	12	5.56%	19	6.55%
Feelings of discouragement or being overwhelmed	4	5.41%	8	3.70%	12	4.14%

Bad or incomplete information	8	10.81%	2	0.93%	10	3.45%
Lack of accountability	3	4.05%	5	2.31%	8	2.76%
Easy to be distracted by another app or social media notification	3	4.05%	4	1.85%	7	2.41%
Comparing oneself to others through social mechanisms within apps	3	4.05%	1	0.46%	4	1.38%

Potential Influencers of Use

In general, family (56.2%, n=289) and friends (53.8%, n=289) were reported to approve use of a diet or fitness app. Parents were specifically called-out as being supportive of use (40%, n=289), especially mothers -- 20.3% of the total sample (n=289) reported that their mother would approve use; only 7.2% of the total sample (n=289) noted that their father would approve use. Interestingly, 9.7% of users (n=215) stated their father would disapprove of use vs. 5.6% (n=215) stating their mother would disapprove of use. Additionally, 16.7% of users (n=215) specifically noted that their siblings would be supportive, as opposed to 9.5% of non-users (n=74).



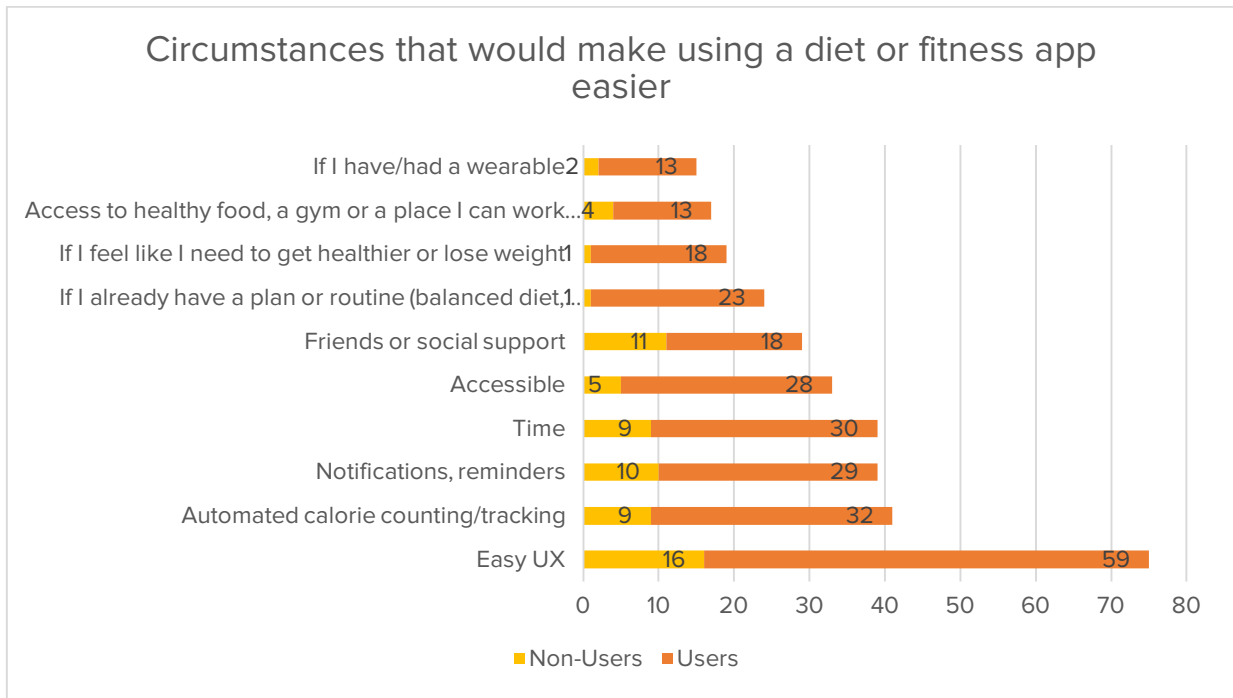
n=289

"No one" was the most common answer when students were asked to think of individuals or groups who would disapprove of use (42.8%, n=289). Family was noted by 31% of users (n=289). Some responses included a caveat such as only disapproving of use "if I was using it in an unhealthy way."

When asked if any other individuals or groups of people made them think of diet or fitness apps, 18.9% of the total participants (n=289) and 25% of active users (n=80) provided a general description of people interested in health or fitness, 15.9% (n=289) named a specific friend. Athletic professionals such as trainers (7.6%, n=289), athletes (6.2%, n=289), and social media celebrities (4.83%, n=289) were also listed, but in a much smaller scale than personal contacts. Also, 7.5% of active users (n=80) reported that diet or fitness apps reminded them of their sorority (the only participants who revealed this were active users).

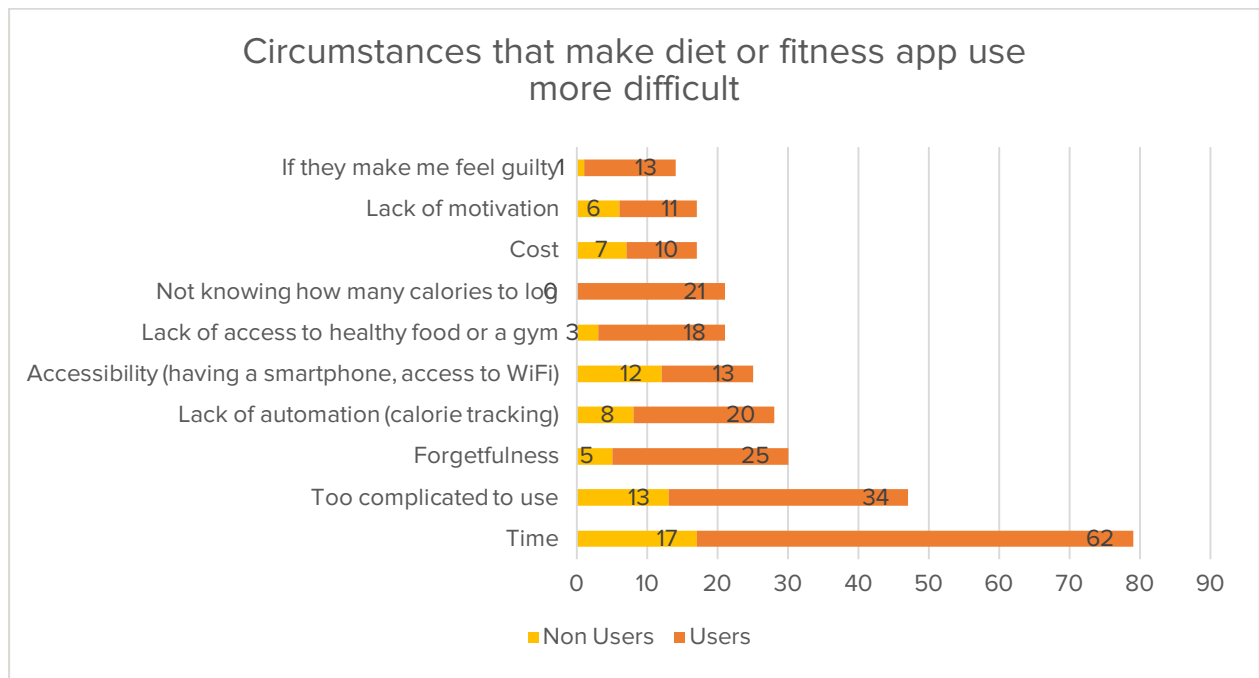
Circumstances that impact use

An easy user experience was the primary circumstance that would make use of a diet or fitness app easier (25.9%, n=289). Time (13.5%, n=289) and receiving notifications or reminders (13.5%, n=289) were also elements that would make use of the app easier among both groups. Automation of calorie counting or tracking was valued among users (14.8% of total users, n=289; and 17.5% of active users, n=80). There was a disparity between users and non-users regarding friends and social support. A higher percentage of non-users than users (14.9% vs. 8.3%; n=74, n=215, respectively) reported that having a friend or some sort of social support system would make it easier for them to use a diet or fitness app. Interestingly, 10.7% of users (n=289) reported that the app was easier to use when they already had a set fitness routine or meal plan, as opposed to using the app to help them develop these practices.



n=289

Time was the biggest variable that prevented use of an app (27.2% total, n=289), followed by a difficult user experience or the idea that the app was too complicated to use (16.2% of total n=289). It was unclear if, by "complicated," some participants meant the user experience with the interface, logging food or exercise, or even general engagement in healthy eating and exercise. Cost was a bigger factor for non-users than users (9.5% vs. 4.6%; n=74, n=215, respectively), as was lack of phone data or storage (6.8% vs. 1.4%; n=74, n=215, respectively). 10% of active users (n=80) said it was difficult to use an app when they had lack of access to healthy food or a gym, versus 4.1% of non-users (n=74). Also, only users reported that they struggle with use when they aren't sure how many calories to log or if nutritional information is unavailable in their app (9.7%, n=289).



n=289

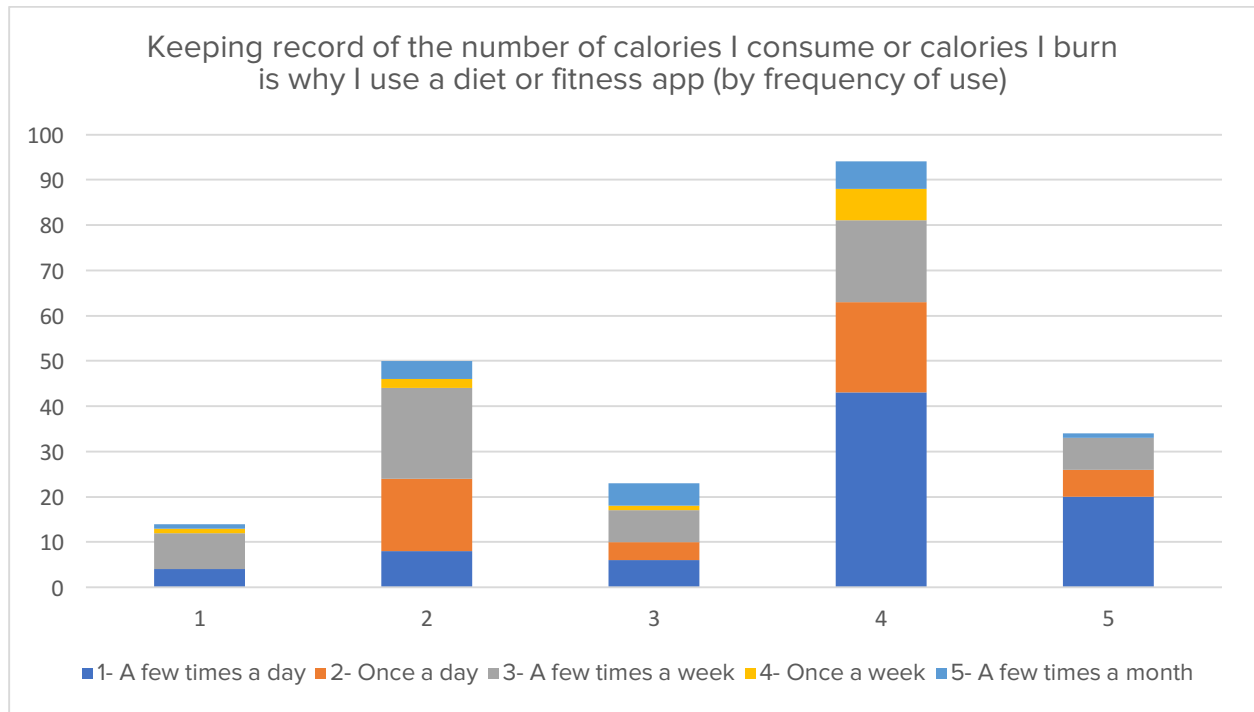
Other associations

When asked what else they associate with diet or fitness applications, 17.2% of all participants (n=289) noted being healthy. Wearables were another popular trend that emerged-- more non-users (10.8%, n=74) than users (5.6%, n=215) associated diet and fitness apps with wearables such as a Fitbit or an Apple Watch. There was also a disparity with the associations of weight loss and development of eating disorders or obsessive behaviors, with only 1.4% of non-users (n=74) and 6.5% of users (n=215) associating apps with weight loss, and 0% of non-users (n=74) versus 5.1% of users (n=215) associating diet and fitness apps with disordered eating or obsessive behavior. Out of the users who associated diet and fitness apps with eating disorders or obsessive behavior, 63% reported logging into the app a few times a day, 36% reported logging in once a day, and only 1% reported logging in within the last thirty days.

RQ2: What is the relationship between use of diet and fitness apps and gratification fulfillment?

Recordability

85% of users agreed or strongly agreed with the statement "Through my diet or fitness app, I can record the number of calories I consume or calories I burn" (n=214, M=4.09) 69% agreed that "Keeping a record of the number of calories I consume or calories I burn is helpful for managing my health" (n=215, M=3.7), and 59.5% agreed that "Keeping record of the number of calories I consume or calories I burn is why I use a diet or fitness app" (n=215, M=3.3). 62.5% of active users (n=80) agreed that they used a diet or fitness app because of record-keeping.

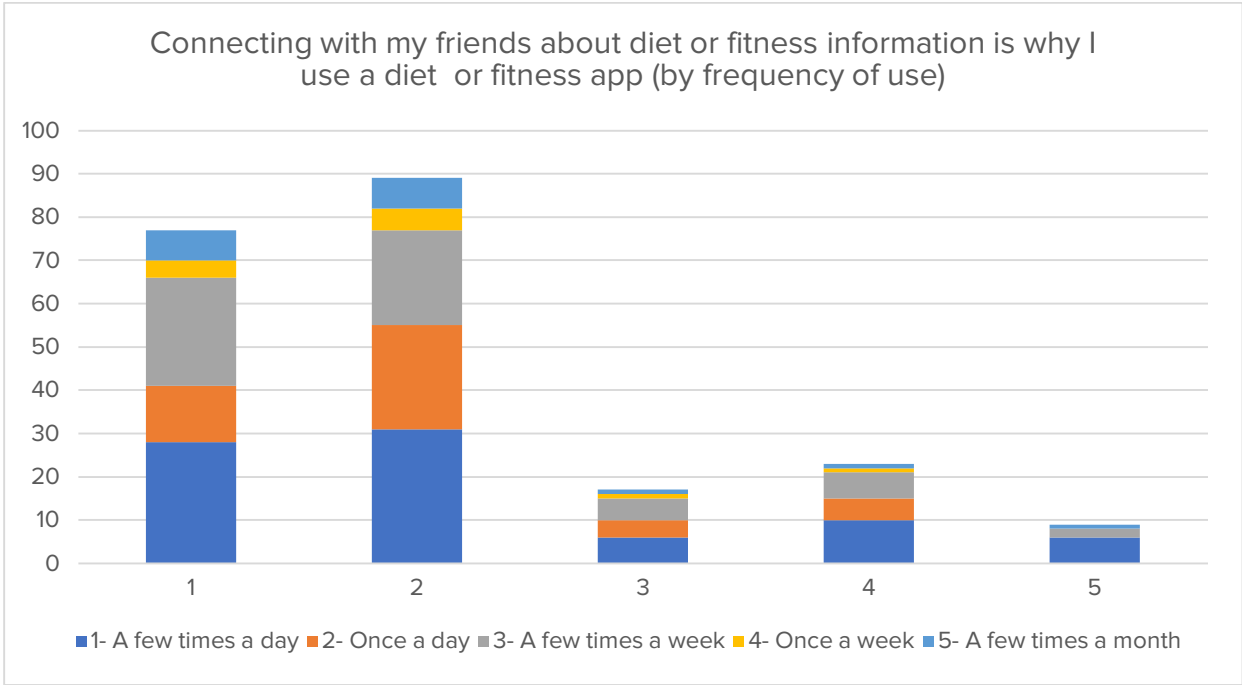


1 = Strongly Disagree, 5 = Strongly Agree

n=215

Networkability

Networkability did not seem to be a motivating factor for use of a diet or fitness app. While 46.5% of users agreed that "Through the diet app I currently use, I can share diet or fitness information with my friends" (n=215, M=3.3) and 34.4% agreed that "Connecting with my friends about diet or fitness information is helpful for managing my health" (n=215, M=2.6), only 14.8% agreed that "Connecting with my friends about diet or fitness information is why I use a diet or fitness app" (n=215, M=2.01). 15% of active users agreed that they used a diet or fitness app to connect with their friends (n=80).

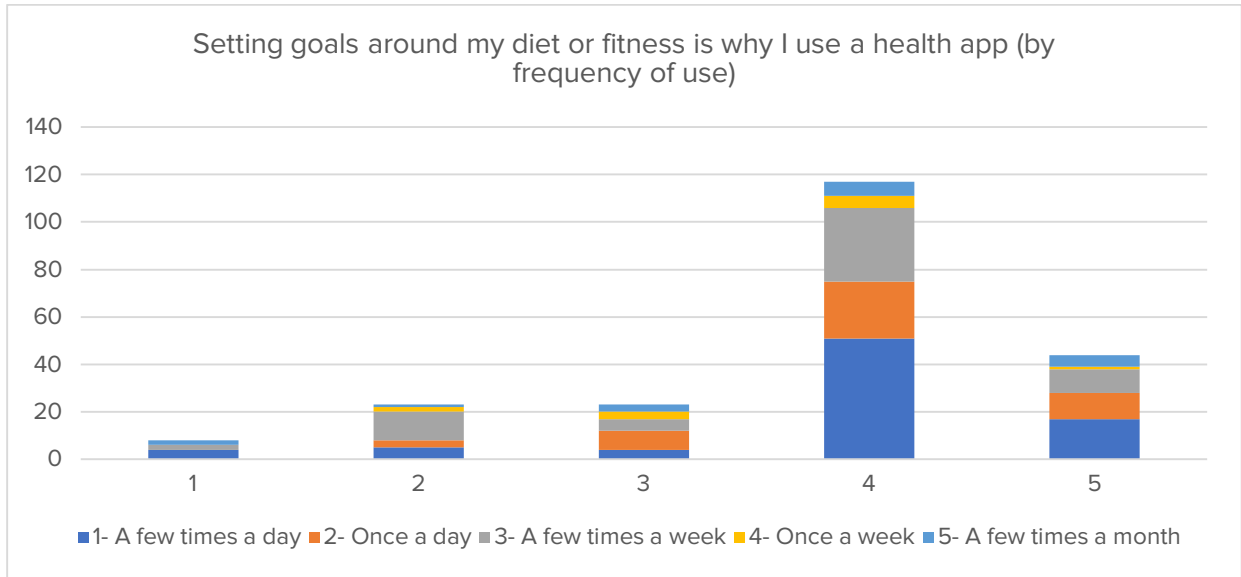


1 = Strongly Disagree, 5 = Strongly Agree
n=215

Goal Setting

Goal setting was the most popular reason, out of those explored in this study, for diet and fitness app use. 92.5% of users agreed that "Through my diet or fitness app, I

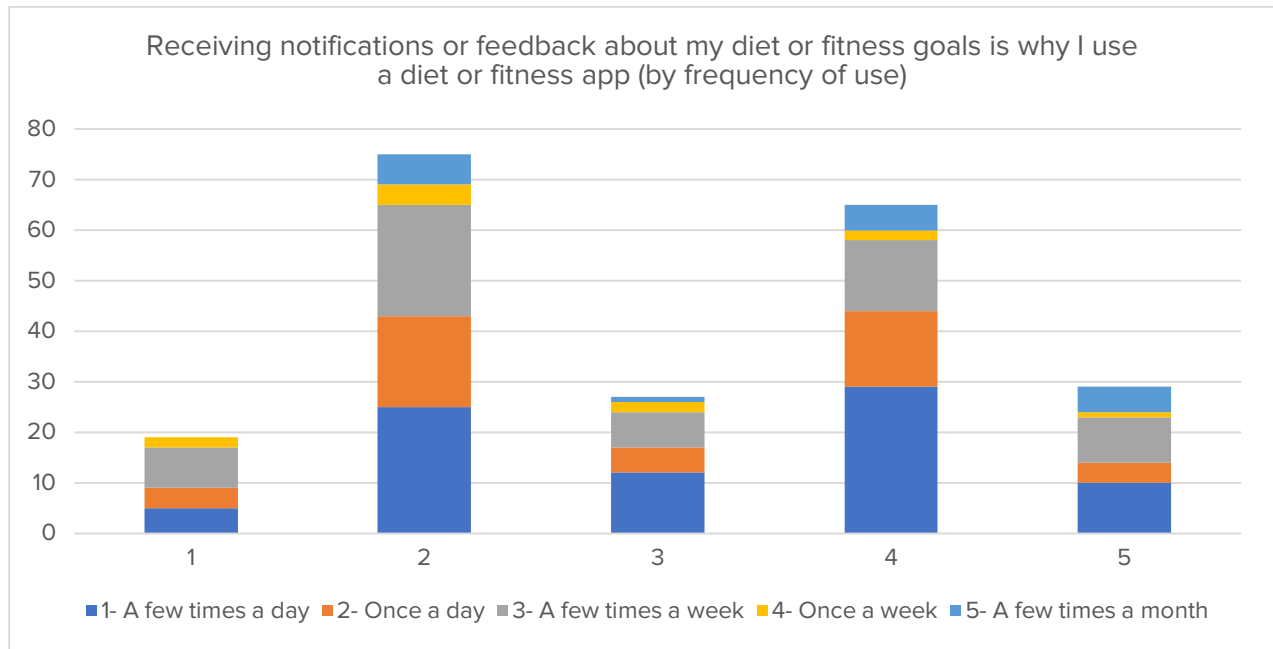
can set diet or fitness goals" (n=215, M=4.3), 90% agreed that " Setting goals around my diet or fitness is helpful for managing my health" (n=215, M=4.2) and 74.9% agreed that "Setting goals around my diet or fitness is why I use a health app" (n=215, M=3.8).



1 = Strongly Disagree, 5 = Strongly Agree
n=215

Notifications

Notifications were a motivator for diet and fitness app use for almost half of users. 73.9% of users agreed that "Through my app, I receive notifications or feedback on achieving my diet or fitness goals" (n=215, M=3.8), 70% agreed that "Receiving notifications or feedback is helpful for reaching my diet or fitness goals" (n=214, M=3.7), and 43.7% agreed that "Receiving notifications or feedback about my diet or fitness goals is why I use a diet or fitness app" (n=215, M=3.04).

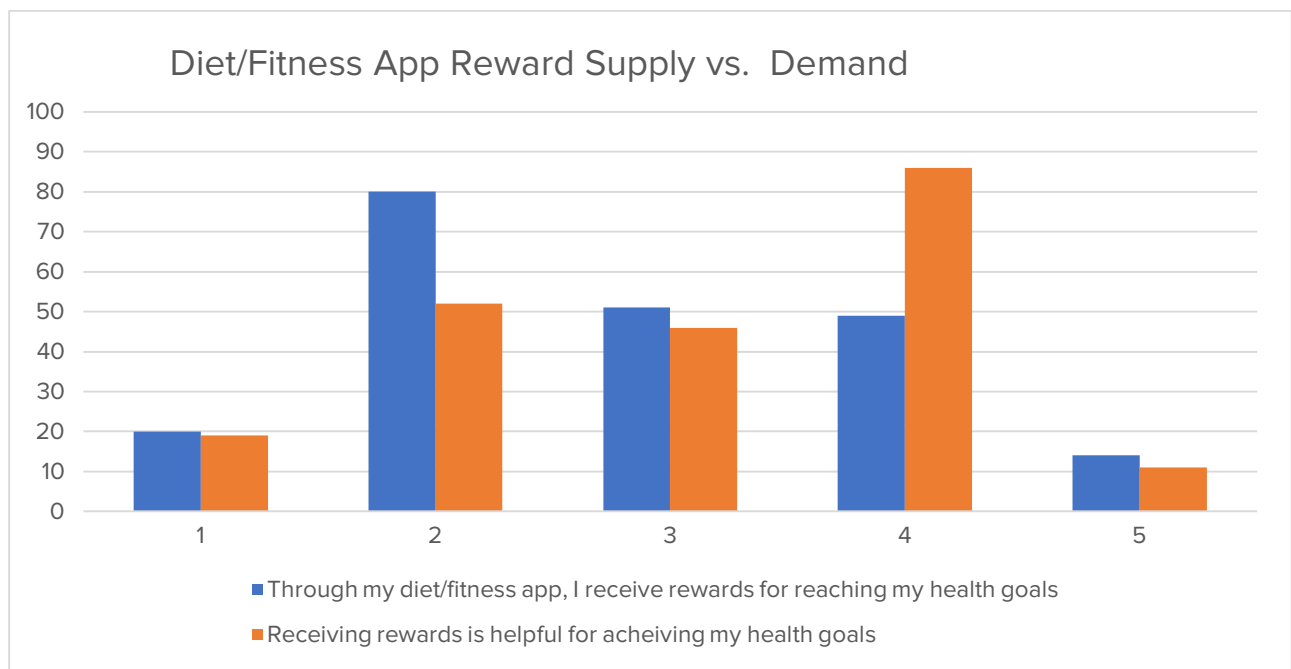


1 = Strongly Disagree, 5 = Strongly Agree

n=215

Rewards

29.4% of users agreed that "Through my diet or fitness app, I receive rewards for meeting my diet or fitness goals" (n=214, M=2.8). Conversely, 45.1% agreed that "Receiving rewards for achieving diet or fitness goals is helpful for reaching my health goals" (n=214, M=3.1). However, only 19.1% of users agreed that "Receiving rewards for achieving diet or fitness goals is why I use a diet or fitness app" (n=214, M=2.4). Out of users who reported receiving rewards for meeting their diet or fitness goals, 49% self-reported receiving some sort of in-app badge, trophy or points, 20% reported intrinsic rewards like feeling accomplished or confident, and 16.9% reported receiving tangible rewards like coupons, gift cards, clothing or beauty products (n=59). 33% reported that these rewards made them motivated to keep working hard and 16.9% said rewards provided them with a sense of accomplishment. 18.6% said the rewards were not motivating, of those, 54.5% reported receiving in-app awards (n=11).

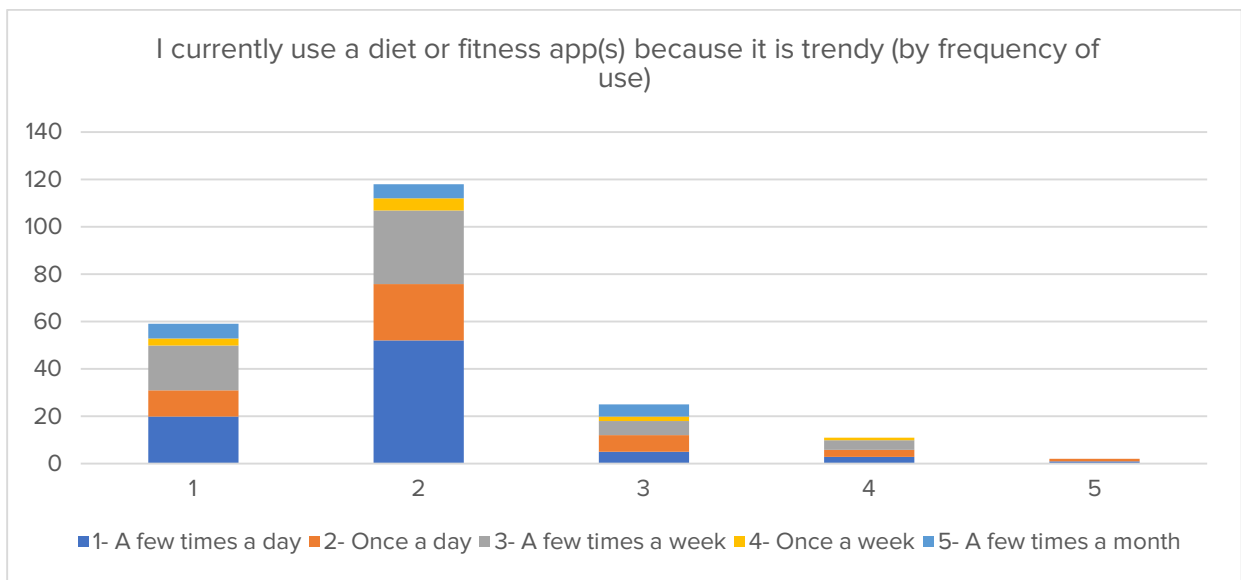
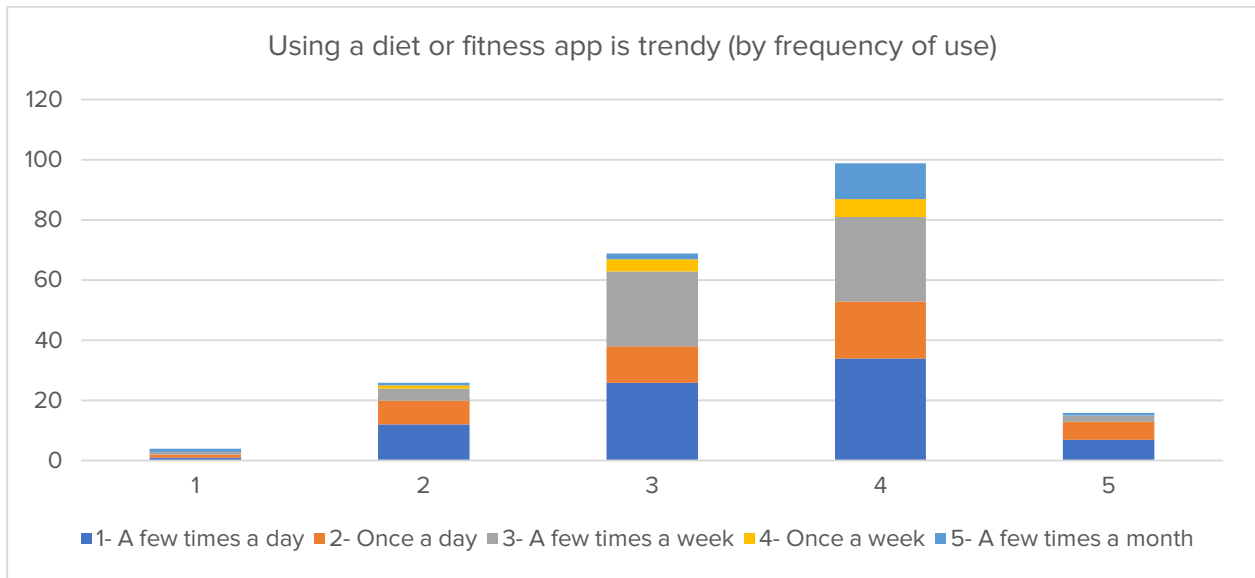


1 = Strongly Disagree, 5 = Strongly Agree

n=214

Trendiness

Trendiness was not a sought gratification of use. While 53.7% of users agreed that "Using a diet or fitness app is trendy" (n=214, M=3.5), only 6% of users agreed that "I currently use a diet or fitness app(s) because it is trendy" (n=215, M=1.9). 6% of people who use diet or fitness apps a few times a week or more (n=187) reported trendiness as a reason for use versus 3% of less frequent users (n=28).



1 = Strongly Disagree, 5 = Strongly Agree

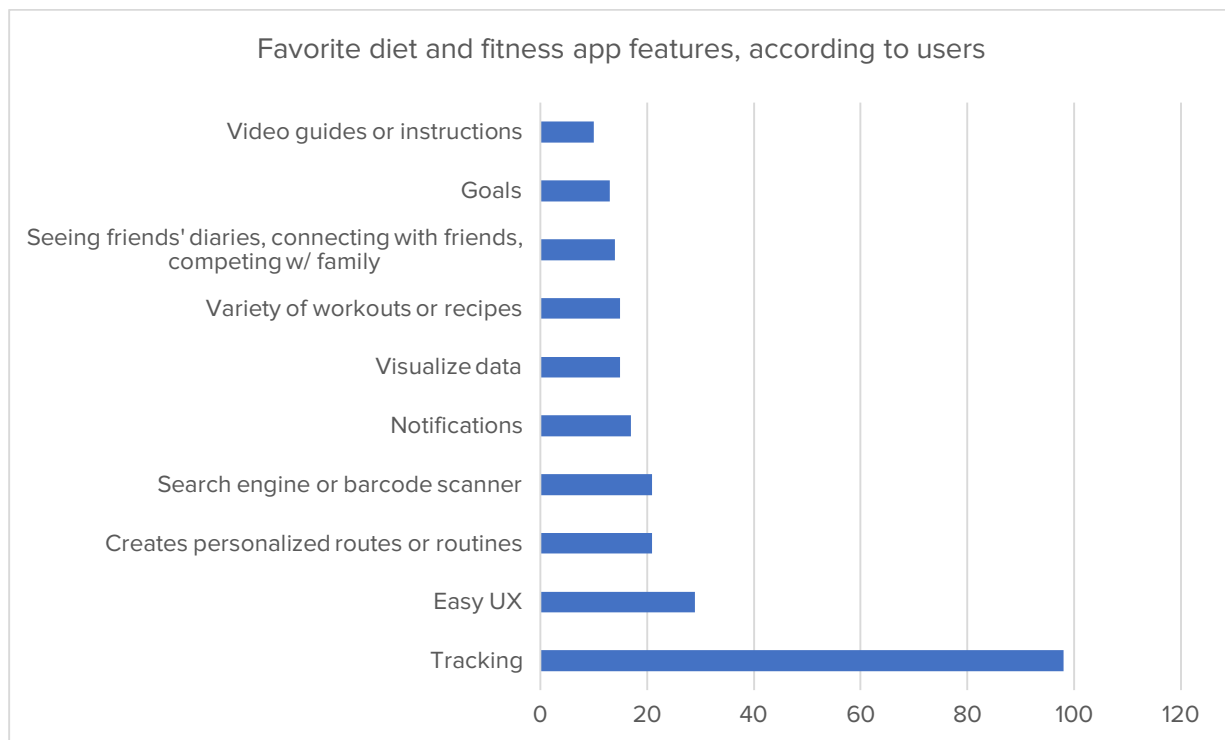
n = 215

Intention to continue use

46.5% of users agreed with the statement "I intend to keep using the diet or fitness app(s) I currently use" (n=215, M=3.2).

Favorite features

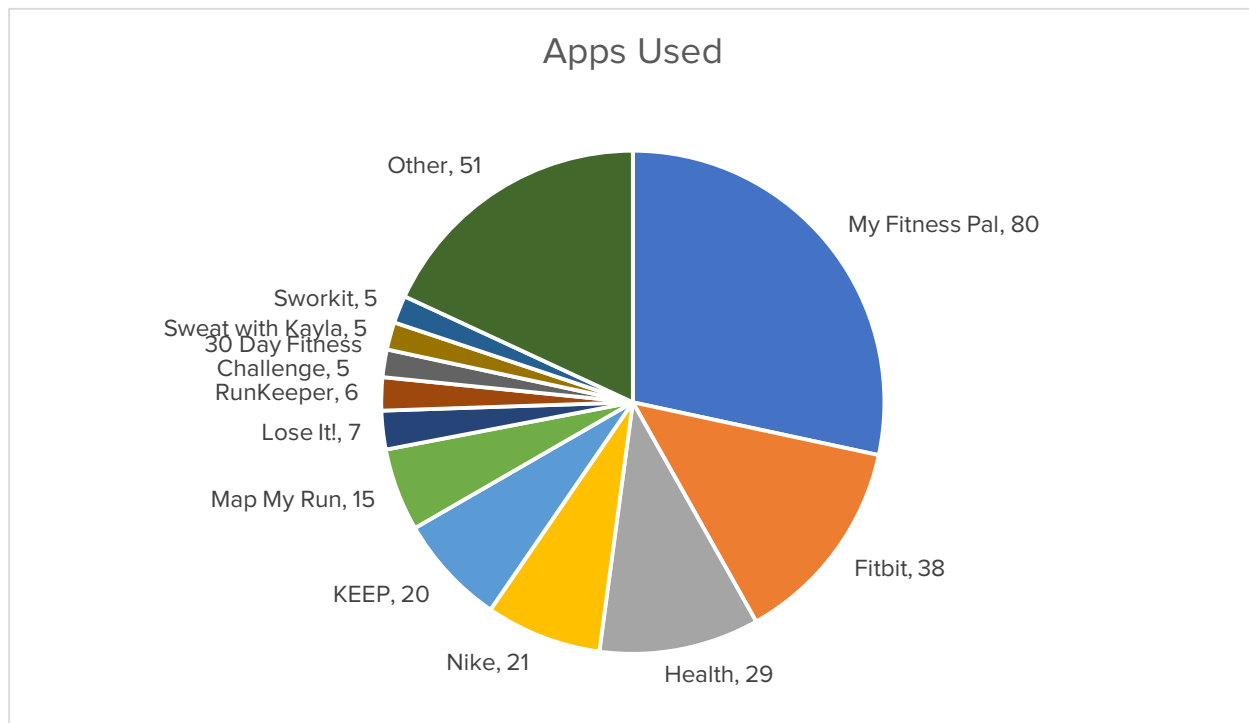
When asked about their favorite features of the diet or fitness app they used, 49.7% of users self-reported tracking or recordability; 14.7% said their app was easy to use; 10.6% noted the personalization of workouts, routes, or recipe suggestions; and 10.6% called out the databases, search engines or barcode scanners used to identify food and calculate calories and nutrients (n=197). Additionally, 8.6% said the notifications were their favorite feature, 7.6% listed data visualization (charts or graphs showing fitness progress or nutrient composition), and 7.1% said connecting with friends or family over the app was their favorite feature (n=197).



n = 197

Apps Used

The most popular app downloaded among users was My Fitness Pal (37.2%, n=215), followed by Fitbit (17.7%, n=215), and the Health app pre-downloaded on the iPhone (13.4%, n=215).



n=215

Out of users who both reported disordered eating as a disadvantage to app use and provided the name(s) of apps that they downloaded, 60% used My Fitness Pal and 13% used the Fitbit app (n=15). Similarly, out of users who reported feeling stressed as a disadvantage to app use, 40% used My Fitness Pal (n=15); 37% of users who reported obsession as a disadvantage to use used My Fitness Pal and 20% used the Fitbit app (n=45). Out of users who reported time and tedium as a disadvantage to app use and provided the name(s) of apps that they downloaded, 40% used My Fitness Pal and 18% used the Health app for iPhone (n=22).

DISCUSSION

This study explored beliefs and gratifications of diet and fitness apps among college-aged users and non-users using the Theory of Reasoned Action and Uses & Gratifications Theory as a framework. It built upon prior studies which investigated general use of smartphone and mHealth apps as well as motivations for continued use of diet and fitness apps. Overall, this study supports prior research in that many perceptions about health apps are tied to their functionality (Cho, Quinlan, et al., 2014; Krebs & Duncan, 2015; Lee & Cho, 2016). Overall, goal setting, recordability, notifications and feedback were perceived among participants as advantages to use and among users as reasons for use. Trendiness was a feature of diet and fitness apps, but does not seem to be a sought gratification. That being said, use based upon trendiness may be difficult to measure through self-reporting, due to social desirability bias. There is an opportunity for further investigation of rewards and how they impact use of diet and fitness apps, as well as behavior changes. These topics are explored in more depth below.

Functional barriers to use include forgetfulness, ease of use (or lack thereof), lack of access to healthy food or a gym, or technical barriers such as lack of data, storage or Wi-Fi. Most of these can be remedied through in-app features such as notifications, a simple user-interface, and development of easy, accessible recipes or exercises that can be performed without equipment. Time management and the effects of diet and fitness apps on student mental health are other barriers to use that will be more difficult to overcome. Both are described in detail below.

Theoretical Framework

The Theory of Reasoned Action proved especially helpful to gain new insights into user and non-user beliefs, influencers, and the elements that contribute to behavioral control and behavioral intention. This study built a foundation upon which future studies

can build a framework to discover more about the attitudes college students hold toward mHealth apps. It also exposed an issue that may be hard to explore further with the TRA -- the feelings of obsession, stress, anxiety or depression reported by respondents in relation to their use of diet or fitness apps. It's recommended that this theoretical framework continue to be used in future research to develop a deeper understanding of user and non-user attitudes and to uncover beliefs about app use held by other populations. The TRA has been criticized by scholars for not considering the impact of emotions on behaviors, and if app users are developing an obsession or if use is impacting their mental and emotional health, then the TRA may be limited in its ability to analyze their perceptions or behaviors. It may still prove useful in analyzing non-user perceptions toward app use to change those perceptions, though.

The Uses and Gratifications Theory provided insight into why users engage with diet and fitness apps. It is unclear whether these motivations were for initial or continued use of an app, and social desirability bias may have had an impact on some answers. The theory could be useful for continued work in this area, as other reasons for use are exposed through more research using other theories as a framework.

Goal Setting

As stated in the results section, out of the elements of diet and fitness apps explored in this study, goal setting is the most popular reason for app use. 92.5% of users agreed that "Through my diet or fitness app, I can set diet or fitness goals" (n=215, m=4.3), 90% agreed that "Setting goals around my diet or fitness is helpful for managing my health" (n=215, m=4.2) and 74.9% agreed that "Setting goals around my diet or fitness is why I use a health app" (n=215, m=3.8). Additionally, 11.8% of participants (n=289) listed goal-setting as an advantage of app use. Prior research also showed that goal setting was a desired function of a health app (Rabin & Bock, 2011).

Goal setting is not only a function desired by users. It's a cornerstone of behavior change and gameplay. Without a specific goal, which implies a change of some sort, is there a point to tracking your health behaviors? Are notifications or feedback mechanisms necessary if there are no benchmarks to be celebrated or progress to be made? App-developers should keep this in mind (in addition to other foundations of behavior change theories!) for future app development.

Recordability

As found in prior research, recordability is a feature of mHealth apps that is functional, expected, and a predictor of continued use (Al Ayubi, Parmanto, Branch, & Ding, 2014; Lee & Cho, 2016; Rabin & Bock, 2011). Not only do users appreciate an app's ability to track their behaviors, they also desire progress reports (Rabin & Bock, 2011). The results of this study corroborate these findings. Again, 69% (n=215) of users agreed that recording their health information was helpful for managing their health and 59.5% (n=215) agreed that recording their health information was a reason for use of an app. Additionally, 56.9% (n=215) of users and 51.4% (n=74) of non-users reported that tracking or recording health information was an advantage to using an app, and 49.7% (n=197) of app users listed a tracking feature as their favorite feature of the app(s) they use. Keep in mind, that while recordability is considered a popular and important feature, it is also associated with time and tedium.

28% of users (n=215) and 18.9% of non-users (n=74) listed time as a disadvantage to use. Automated systems such as wearables (e.g. Fitbit), GPS tracking devices, and step counters in smartphones have ameliorated the need for time logging of steps or calories burned for many app users; however, automation of calorie consumption is another challenge. While the technology is under development and available on the consumer market (Van Camp, 2017), an affordable, tested, and user-friendly automated solution for calorie and nutrient consumption is still unavailable. Although automated

technology could be available relatively soon, automation brings up questions of user learning and information retention, since historically, behavior change interventions have relied on the recording of information (there's something to be said about manually logging your work!). Therefore, if automated calorie tracking makes its way into our culture in the way that Fitbit has, more research is suggested on the effects of automatic tracking on awareness (which in and of itself was reported by 28.2% of users (n=215) as an advantage to using a diet or fitness app!).

Recordability has been shown again and again to be a pillar of diet and fitness app production, as well as general behavior change programming, and should be prioritized as a feature for future apps. Automation is an in-demand feature that could be appealing from a consumer standpoint, but its effects on health outcomes should be tested. Additionally, despite its standing as a top feature of diet and fitness apps, the time and tedium associated with it makes it a barrier to use for some users or potential users. Nevertheless, recordability should be a feature that developers continue to consider.

Notifications + Feedback Mechanisms

Despite the potential to be "annoying," according to a handful of participants, notifications were valued among a significant portion of the sample population. 70% of users (n=197) agreed that notifications were helpful in achieving their diet or fitness goals, and 43.6% (n=197) agreed that it is a reason they use a diet or fitness app. 12.5% of all respondents (n=289) reported that notifications, reminders, and feedback were advantages to using a diet or fitness app, and 13.5% of respondents (n=289) reported that notifications make it easier to use an app. 8.6% of users (n=197) even listed notifications as their *favorite* feature of the app(s) they use. Presumably, this is to counter the disadvantage of users' tendency to forget the app, as reported by 7.6% of respondents (n=289).

On a related note, reward-like feedback mechanisms such as badges and points were reported to be effective motivators for use for some participants. As one user stated, "I just like to see all areas 'green' in my progress report, that motivates me." Again, 33% of users who reported receiving rewards through their app(s) (n=59) reported that these rewards made them motivated to keep working hard and 16.9% said rewards provided them with a sense of accomplishment. However, 18.6% said the rewards were not motivating, and of those, 54.5% reported receiving in-app awards (n=11). More exploration on rewards is discussed below.

It's recommended that notifications and feedback mechanisms such as reminders for use, encouragement to continue a healthy behavior, or status updates on a goal, be included in future app development. These features often keep many users engaged and motivated to continue with their progress. However, these reminders could also be the cause of feelings of anxiety, stress, or depression that some users report as a disadvantage to app use; they could also cause or trigger obsessive behaviors or thoughts about the app or eating. More research should be conducted in this area, especially in the case of diet-focused apps.

Rewards

Related to notifications and feedback mechanisms are reward systems in apps. This is a potential area of opportunity for app developers, health and wellness brands or healthcare providers. While 45.1% of users (n=214) noted that receiving rewards was helpful for achieving their diet and fitness goals, only 29.4% reported using an app with that functionality. Open-ended responses revealed that only 16.9% of users who reported receiving rewards from their app(s) (n=59) received rewards that they could use outside of the app, such as health insurance benefits, coupons, gift cards, or merchandise. As one participant put it when asked why the reward was motivating, "[I] can use points for

rewards in real life." On the other hand, other users replied that external rewards were not motivating factors for use:

"I usually don't care too much about the rewards. I use the app to make sure I'm meeting my daily dietary needs."

" These do not motivate me. I would rather see physical results."

" It doesn't. I am motivated by myself."

Further research on the impact of "real world" rewards on mHealth apps and health behavior change is recommended. If these types of rewards are a motivating factor for users to engage with the apps to reach their goals, it would not only be a win for the users. Health and wellness brands would have an opportunity to promote themselves and their products to their target audience. There could be similar implications for the insurance market, if users were able to receive health insurance reimbursements for engaging in healthy behaviors that are recorded through the app, although this does raise some logistical, ethical, and privacy concerns. It should also be noted that this type of benefit may not motivate a college student, who may still be covered under their parents' insurance or have an affordable student plan, but it would eventually be of interest after graduation.

Time

Time was reported as the biggest circumstance that would make use of a diet or fitness app difficult. In many responses, it was unclear if students meant they did not have time to use the app, or if they did not have time to work out or to plan and prepare healthy meals. Assuming they are exercising or preparing healthy meals, use of the app

may not be necessary (from a health benefits standpoint). However, the latter is likely the case. If students lack the intention to exercise or eat "right," then they lack the intention to use the app.

Mental Health

As noted by a number of respondents in this study, diet and fitness apps can trigger mental health issues. Notifications can spark feelings of guilt or shame if users haven't been working out, eating healthy, or logging their behaviors. Study participants reported additional disadvantages to use like decreased feelings of self-esteem (6.55%, n=289) or comparison to others (1.38%, n=289). It should also be noted that a higher percentage of non-users than users cited many of these disadvantages to use, which indicates potential barriers to entry for some people who may actually benefit from using an app. Additionally, users of the most popular reported apps like My Fitness Pal, Fitbit, and Health reported these disadvantages more so than users of other apps.

If users don't feel good when they think about the app, chances are they will eventually stop using it or delete it from their phone. What's worse is that users could continue to use the app to perpetuate unhealthy behaviors like disordered eating. As noted in the results section, "obsession" was the primary disadvantage of use listed by users and non-users alike, and almost ten percent of non-users listed an eating disorder as a disadvantage to use.

If they are not already, app developers should be aware that their technology could spark this type of reaction in users.

INSIGHTS + RECOMMENDATIONS

Following are insights and recommendations which could be useful for app developers:

Health Behavior Change, Game Research + Reaching Those Who Need It Most

Prior research has shown that the typical diet and fitness app user is someone who already has the motivation or intention to change their behavior; this study revealed that some users perceive apps as useful only when they "already have a plan" in place to practice healthy behaviors. This could also explain why goal-setting was such an important feature to many study participants. These users may have engaged in healthy behaviors with or without the app-- the app is just a convenient tool for them to organize and track their goal progress, not the initial motivator for behavior. But what about those students who lack the motivation to engage in healthy behaviors? How do we engage them? Games might provide a solution.

This study focused on basic functionalities of diet and fitness apps that users have identified as useful and that relate to gamification of apps. While the game elements explored here are crucial to the development of any game, there are other interesting game features currently being used by health and non-health apps alike that could also inspire behavior change. Examples are the use of avatars in the Nike+ app (McGonigal, 2011), the augmented reality seen in Pokemon Go -- a non-health app that got a lot of people moving around the world -- and the narrative aspect to Zombies, Run! (Franz & Berquist, 2016). Future research on augmented reality, avatars and narrative on user health behaviors (especially for un-motivated users) is recommended.

Diet + Fitness App Development

The mHealth app market is becoming oversaturated-- demand is not keeping up with supply (Research2Guidance, 2016). To navigate this competitive marketplace, mHealth app developers are torn between a variety of (potentially) conflicting goals. Ultimately, their primary goal is to help people, as reported by 53% of developers themselves (Research2Guidance, 2016). However, generating revenue follows closely behind (52%), and the need to get apps to market quickly (35%) is yet another priority (Research2Guidance, 2016). Building a quality product that serves customers or patients well will eventually lead to higher revenue. And although getting on the market quickly and fixing bugs later could provide a quick learning curve for navigating the app market, it could also affect customer satisfaction and perceptions of the brand of the app.

It's recommended that diet and fitness app developers continue to focus on the quality of the product first and foremost, which means performing a thorough examination of behavior change literature and consulting with healthcare experts. Many companies already do the latter. In 2016, 42% of app developers reported having medical professionals on their team, and 43% reported consulting with health professionals; however, the number of companies which did not work with medical professionals jumped from 3% in 2015 to 11% in 2016 (Research2Guidance, 2016). There is already much debate over whether diet and fitness apps can help users to achieve results (Eapen & Peterson, 2015; Zhao, J., Freeman, B., & Li, 2016), and a high quantity of apps that do not follow behavior change recommendations (Yang, Maher, & Conroy, 2015). Continuing this growing trend of not consulting health and behavior change professionals to build behavior change apps could just add more snake oil to the market versus competitive, quality product.

LIMITATIONS + SUGGESTIONS FOR FUTURE RESEARCH

This study consisted of a convenience sample of undergraduate college students in the School of Journalism at the University of Minnesota. Given that many of these students regularly take classes about digital communication, they may have a different perspective about this topic than the broader population. Also, a very high percentage of respondents were white and female. While this is somewhat representative of the Journalism School population, it is not generalizable to many other groups. Additionally, the author of this study was a Teaching Assistant at the University of Minnesota; it's possible that some participants were her students, which could have impacted how they responded to the prompts. More research should be done to explore this topic with a sample that is larger and more diverse in race/ethnicity, gender, and academic interest.

From a methodology standpoint, the qualitative portions of this study relied on self-reported data from participants. Also, while this study focused on functional features of apps, it did not explore use of other elements of gamification or use of diet and fitness apps on actual health outcomes.

Despite these limitations, this study provided a framework for future research on college student perceptions of diet and fitness apps. Future research should focus on continuing to develop an understanding of college student beliefs and attitudes toward diet and fitness apps, gratifications received from diet and fitness apps, and how students (and all users) who want to utilize apps, can do so in a healthy manner.

CONCLUSION

This study explored perceptions of diet and fitness apps among users and non-users using the Theory of Reasoned Action and Uses & Gratifications Theory as a framework. It built upon prior studies which investigated general use of smartphone and mHealth apps as well as motivations for continued use of diet and fitness apps. Diet and fitness apps could be especially useful for promoting and managing health among college students. As digital natives, they are accustomed to using technology in various aspects of their lives. Many of them are also undergoing significant life changes--gaining independence, learning to manage their schedules, and either cooking for themselves or managing their own meals. This transitional time is also when young people begin to develop habits that could stick with them and impact their health for the remainder of their lives. The onset of digital technology and smartphone mHealth apps may offer a solution to help students manage their health goals -- whether they be weight loss, fitness goals, or general health management. Prior research revealed that users of diet and fitness apps are already health conscious, and apps can provide a solution for them to record and track their behaviors and progress toward goals. This study helped to verify that notion. Goal setting and tracking were popular reasons for use and should be included as primary features in future app development. Notifications and feedback systems were also valued features. There are opportunities for more research about rewards for health behaviors. Additionally, further research should be conducted to investigate whether other game elements (such as augmented reality or narrative) could inspire non-motivated students to engage in healthy behaviors.

While this study supported prior research about successful features of apps, it also revealed a darker side to diet and fitness app use that developers should be keenly aware of. Users and non-users alike perceive apps to promote or perpetuate obsession (it's unclear if this obsession is with the app or with behaviors), disordered eating, and

feelings that impact the self-worth of the user. App developers must ask themselves what their ultimate goal is in app production and consider the mental or emotional cost that some features might inflict on their users.

APPENDIX I - SURVEY QUESTIONNAIRE

Missi Rossi
Capstone Survey - Usage of Digital Mobile Health Applications

The use of mobile health and wellness applications that help people to stay healthy has increased significantly over the last few years. This survey explores the use of health applications among college students like you.

1. Do you own a smartphone? Y/N (if no, done) (if yes, Q2)
2. Have you ever downloaded any of the following mobile applications onto your smartphone? (check all that apply) I have downloaded a diet-only mobile application, I have downloaded a fitness-only mobile application, I have downloaded a mobile application that tracks both diet *and* fitness, I have never downloaded any diet or fitness mobile applications
3. How often do you log into the diet mobile application you downloaded? a few times a day, once a day, a few times a week, once a week, a few times a month, once a month, I have never logged in
4. How often do you log into the fitness mobile application you downloaded? a few times a day, once a day, a few times a week, once a week, a few times a month, once a month, I have never logged in
5. How often do you log into the diet and fitness mobile application you downloaded? a few times a day, once a day, a few times a week, once a week, a few times a month, once a month, I have never logged in

If Q2 "I have not downloaded any..." or if Q3, Q4, Q5 "a few times a month" or "I have never logged in":

The next series of questions is about your perceptions of using a diet or fitness mobile application to help you stay healthy. Please write down everything that comes to mind.

What do you see as the advantages of using a diet or fitness mobile application? What are the good things that might happen if you began using a diet or fitness mobile app?

What do you see as the disadvantages of using a diet or fitness mobile application? What are the bad things that might happen if you began using a diet or fitness mobile application?

Please list all the individuals or groups who would approve of, or think that you should use, a diet or fitness mobile application?

Please list all the individuals or groups who would disapprove of, or think that you should not use, a diet or fitness mobile application?

Are there any other individuals or groups who come to mind when you think about using a diet or fitness mobile application?

What factors, circumstances or settings might enable or make it easier for you to use a diet or fitness mobile application?

What factors, circumstances, or settings would make it difficult or prevent you from using a diet or fitness mobile application?

Is there anything else that you associate with using a diet or fitness mobile application?

If Q5 "a few times a day" through "a few times a month":

The next series of questions is about your perceptions of using a diet or fitness mobile application as part of your health regimen. Please write down everything that comes to mind.

What do you see as the advantages of using a diet or fitness mobile application? What are the good things that happen when you use a diet and fitness mobile app?

What do you see as the disadvantages of using a diet or fitness mobile application? What are the bad things that happen when you use a diet and fitness mobile application?

Please list all the individuals or groups who would approve of, or think that you should use, a diet or fitness mobile application?

Please list all the individuals or groups who would disapprove of, or think that you should not use, a diet or fitness mobile application?

Are there any other individuals or groups who come to mind when you think about using a diet or fitness application?

What factors, circumstances or settings make it easier for you to use a diet or fitness mobile application?

What factors, circumstances, or settings make it difficult or prevent you from using a diet or fitness mobile application?

Is there anything else that you associate with using a diet or fitness mobile application?

The next set of questions are about the features of your diet and fitness app(s). Please choose how much you agree or disagree with the following statements (Strongly disagree=1, Strongly agree=5)

Through my diet or fitness app(s), I can record the amount I exercise or calories burned through exercise.

Keeping a record of the amount I exercise or calories burned through exercise is helpful for managing my health.

Keeping a record of the amount I exercise or calories burned through exercise is a feature of the diet and fitness app I currently use.

Keeping a record of the amount I exercise or calories burned through exercise is why I currently use a diet and fitness app.

Through my diet or fitness app(s), I can record the number of calories I consume.

Keeping a record of the number of calories I consume is helpful for managing my health.

Keeping a record of the number of calories I consume is a feature of the diet or fitness app(s) I currently use.

Keeping record of the number of calories I consume is why I use a diet or fitness app.

Through the diet or fitness app(s) I currently use, I can share diet and fitness information with other users.

Through the diet or fitness app(s) I currently use, I can access diet and fitness information provided by other users.

Through the diet and fitness app(s) I currently use, I can share diet and fitness information with my friends.

Connecting with my friends about diet and fitness information is why I use a diet or fitness app.

Through my diet and fitness app(s), I can set diet and fitness goals.

Setting goals around my diet and fitness activity is helpful for managing my health.

Setting goals around my diet and fitness activity is why I use a diet and fitness app.

Through my diet and fitness app(s), I receive notifications or feedback on achieving my diet and fitness goals.

Receiving notifications or feedback is helpful for reaching my diet and fitness goals.

Receiving notifications or feedback about my diet and fitness goals is why I use a diet and fitness app.

Receiving rewards for achieving diet and fitness goals is helpful for reaching my diet and fitness goals.

Receiving rewards for achieving diet and fitness goals is why I use a diet and fitness app.

Using a diet and fitness app is trendy.

I currently use a diet and fitness app(s) because it is trendy.

I intend to keep using the diet and fitness app(s) I currently use.

I would recommend the diet and fitness app(s) I currently use to a friend.

Which diet and fitness app(s) do you currently use?

Is there anything else you would like to share about why you use of diet and fitness apps or your favorite features of the app(s) you use?

If agree to "receiving rewards...why I use..."

What kinds of rewards do you receive?

(diet) How do these rewards motivate you to achieve your diet goals?

(fitness) How do these rewards motivate you to achieve your fitness goals?

(diet + fitness) How do these rewards motivate you to achieve your diet and fitness goals?

What is your age?

What is your year in school? Freshman/Sophomore/Junior/Senior/Other

What is your gender? M/F/Non-binary

What is your race/ethnicity?

References

- Al Ayubi, S. U., Parmanto, B., Branch, R., & Ding, D. (2014). A Persuasive and Social mHealth Application for Physical Activity: A Usability and Feasibility Study. *JMIR mHealth and uHealth*, 2(25). <http://doi.org/http://doi.org/10.2196/mhealth.2902>
- Alahäivälä, T., & Oinas-Kukkonen, H. (2015). Understanding persuasion contexts in health gamification: A systematic analysis of gamified health behavior change support systems literature. *International Journal of Medical Informatics*, 96, 62–70. <http://doi.org/10.1016/j.ijmedinf.2016.02.006>
- Boxall, A. (2014). 2014 is the year of health and fitness apps, says Google. Retrieved January 1, 2017, from <https://www.digitaltrends.com/mobile/google-play-store-2014-most-downloaded-apps/>
- Carter, M. C., Burley, V. J., & Cade, J. E. (2017). Weight Loss Associated With Different Patterns of Self-Monitoring Using the Mobile Phone App My Meal Mate. *JMIR mHealth and uHealth*, 5(2), e8. <http://doi.org/10.2196/mhealth.4520>
- Childhood Obesity Facts. (n.d.). Retrieved April 10, 2017, from <https://www.cdc.gov/obesity/data/childhood.html>
- Cho, J., Lee, H. E., Kim, S. J., & Park, D. (2015). Effects of Body Image on College Students' Attitudes Toward Diet/Fitness Apps on Smartphones. *Cyberpsychology, Behavior, and Social Networking*, 18(1), 41–45. <http://doi.org/10.1089/cyber.2014.0383>
- Cho, J., Park, D., & Lee, H. E. (2014). Cognitive factors of using health apps: Systematic analysis of relationships among health consciousness, health information orientation, eHealth literacy, and health app use efficacy. *Journal of Medical Internet Research*, 16(5), 1–10. <http://doi.org/10.2196/jmir.3283>
- Cho, J., Quinlan, M. M., Park, D., & Noh, G. Y. (2014). Determinants of adoption of smartphone health apps among college students. *American Journal of Health Behavior*, 38(6), 860–870. <http://doi.org/10.5993/AJHB.38.6.8>

- Cowan, L. T., Van Wagenen, S. A., Brown, B. A., Hedin, R. J., Seino-Stephan, Y., Hall, P. C., & West, J. H. (2013). Apps of Steel: Are Exercise Apps Providing Consumers With Realistic Expectations? *Health Education & Behavior, 40*(2), 133–139.
<http://doi.org/10.1177/1090198112452126>
- Cummiskey, M. (2011). There's an App for That Smartphone Use in Health and Physical Education. *Journal of Physical Education, Recreation & Dance, 82*(8), 24–30.
<http://doi.org/10.1080/07303084.2011.10598672>
- Eapen, Z. J., & Peterson, E. D. (2015). Can mobile health applications facilitate meaningful behavior change? *Journal of American Medical Association, 314*(12), 1236–1237.
<http://doi.org/10.1073/pnas.0703993104>
- Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention and Behavior*. Reading, MA: Addison-Wesley Publishing Company.
- Fishbein, M., & Ajzen, I. (2010). *Predicting and Changing Behavior*. New York, NY: Taylor & Francis Group.
- Fox, S., & Duggan, M. (2012). *Mobile Health 2012. Pew Internet: Washington, D.C.*
Retrieved from
http://www.pewinternet.org/~media/Files/Reports/2012/PIP_MobileHealth2012_FIN AL.pdf
- Franz, J., & Berquist, C. (2016). Apps That Turn Your Workout Into a Game. Retrieved from
<https://www.sciencefriday.com/segments/apps-that-turn-your-workout-into-a-game/>
- Harris. (2013). Pearson Student Mobile Device Survey National Report : College Students, 25.
- Ho, H. Y., & Syu, L. Y. (2010). Uses and gratifications of mobile application users. *ICEIE 2010 - 2010 International Conference on Electronics and Information Engineering, Proceedings, 1*(Iceie 2010), 315–319. <http://doi.org/10.1109/ICEIE.2010.5559869>
- Joo, J., & Sang, Y. (2013). Exploring Koreans' smartphone usage: An integrated model of the technology acceptance model and uses and gratifications theory. *Computers in*

- Human Behavior*, 29(6), 2512–2518. <http://doi.org/10.1016/j.chb.2013.06.002>
- Katz, E., & Gurevitch, M. (1973). On the Use of the Mass Media for Important Things, 38(2), 164–181.
- Knight, E., Stuckey, M. I., Prapavessis, H., & Petrella, R. J. (2015). Public Health Guidelines for Physical Activity: Is There an App for That? A Review of Android and Apple App Stores. *Robert J Petrella. Originally Published in JMIR Mhealth and Uhealth*, 643(32), 33–43. <http://doi.org/10.2196/mhealth.4003>
- Kratzke, C. (2012). *Smartphone_technology_and_apps.PDF*.
- Krebs, P., & Duncan, D. T. (2015). Health App Use Among US Mobile Phone Owners: A National Survey. *JMIR mHealth and uHealth*, 3(4), e101. <http://doi.org/10.2196/mhealth.4924>
- Lee, H. E., & Cho, J. (2016). What Motivates Users to Continue Using Diet and Fitness Apps? Application of the Uses and Gratifications Approach. *Health Communication*, 0(0), 1–9. <http://doi.org/10.1080/10410236.2016.1167998>
- Lister, C., West, J. H., Cannon, B., Sax, T., & Brodegard, D. (2014). Just a fad? Gamification in health and fitness apps. *JMIR Serious Games*, 2(2), e9. <http://doi.org/10.2196/games.3413>
- McGonigal, J. (2011). *Reality is Broken: Why Games Make Us Better and How They Can Change the World*. Penguin Group.
- National College Health Assessment: Undergraduate Student Reference Group, Executive Summary, Fall 2016*. (2016).
- Perloff, R. M. (2014). *The Dynamics of Persuasion* (Fifth Edit). New York, NY: Routledge.
- Rabin, C., & Bock, B. (2011). Desired Features of Smartphone Applications Promoting Physical Activity. *Telemedicine and E-Health*, 17(10), 801–803. <http://doi.org/10.1089/tmj.2011.0055>
- Research2Guidance. (2016). *MHEALTH APP DEVELOPER ECONOMICS 2016*. Berlin, Germany.

- Rubin, A. M. (2009). The uses-and-gratifications perspective on media effects. In J. Bryant & M. B. Oliver (Eds.), *Media Effects: Advances in theory and research* (3rd ed., pp. 165–184). New York, NY: Routledge.
- Schoeppe, S., Alley, S., Van Lippevelde, W., Bray, N. A., Williams, S. L., Duncan, M. J., & Vandelanotte, C. (2016). Efficacy of interventions that use apps to improve diet, physical activity and sedentary behaviour: a systematic review. , 13, 127. *The International Journal of Behavioral Nutrition and Physical Activity*, 13(127). Retrieved from <http://doi.org/10.1186/s12966-016-0454-y>
- Sharma, A., Madaan, V., & Petty, F. D. (2006). Exercise for Mental Health. *Primary Care Companion to The Journal of Clinical Psychiatry*, 8(2), 106.
- Sparling, P. B. (2007). Obesity on Campus. *Preventing Chronic Disease*, 4(3), 6–9.
- Sundar, S. S., & Limperos, A. M. (2013). Uses and Grats 2.0: New Gratifications for New Media. *Journal of Broadcasting & Electronic Media*, 57(4), 504–525. <http://doi.org/10.1080/08838151.2013.845827>
- Van Camp, J. (2017). EXCLUSIVE: WE TESTED THE WORLD'S FIRST AUTOMATIC CALORIE COUNTER, AND IT WORKS! Digital Trends. Retrieved from <https://www.digitaltrends.com/wearables/healbe-gobe-review/3/>
- West, D. S., Monroe, C. M., Turner-McGrievy, G., Sundstrom, B., Larsen, C., Magradey, K., ... Brandt, H. M. (2016). A technology-mediated behavioral weight gain prevention intervention for college students: Controlled, quasi-experimental study. *Journal of Medical Internet Research*, 18(6), 1–13. <http://doi.org/10.2196/jmir.5474>
- Yang, C.-H., Maher, J. P., & Conroy, D. E. (2015). Implementation of Behavior Change Techniques in Mobile Applications for Physical Activity. *American Journal of Preventive Medicine*, 48(4), 452–455. <http://doi.org/10.1016/j.amepre.2014.10.010>
- Zhang, X., Guo, X., Lai, K., Guo, F., & Li, C. (2014). Understanding Gender Differences in m-Health Adoption: A Modified Theory of Reasoned Action Model. *Telemedicine and E-Health*, 20(1), 39–46. <http://doi.org/10.1089/tmj.2013.0092>

Zhao, J., Freeman, B., & Li, M. (2016). Can Mobile Phone Apps Influence People's Health Behavior Change? An Evidence Review. *Journal of Medical Internet Research*, 18(11). <http://doi.org/doi.org/10.2196/jmir.5692>

Zuckerman, O., & Gal-Oz, A. (2014). Deconstructing gamification: evaluating the effectiveness of continuous measurement, virtual rewards, and social comparison for promoting physical activity. *Personal and Ubiquitous Computing*, 18(7), 1705–1719. <http://doi.org/10.1007/s00779-014-0783-2>