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AN EXPLORATION OF WEARABLE ACTIVITY TRACKER USE BY YOUNG  
ADULTS

A DISSERTATION APPROVED FOR THE  
DEPARTMENT OF HEALTH AND EXERCISE SCIENCE

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I want to dedicate this to my husband, James. You are the reason that I was able to dream this dream and see it come true. I love you.

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## Table of Contents

Acknowledgements .....	iv
List of Tables .....	xii
Abstract.....	xiii
Chapter 1: Introduction.....	15
Purpose of Studies .....	17
Research Questions: Study 1 .....	18
Research Questions: Study 2 .....	18
Hypotheses .....	18
Significance of the Research .....	20
Delimitations .....	23
Limitations.....	24
Assumptions .....	24
Operational Definitions .....	24
Chapter 2: Literature Review .....	26
Obesity in the United States .....	26
Health Consequences of Obesity .....	26
Economic Consequences of Obesity .....	27
Demographic Differences in Obesity .....	27
Behaviors Associated with Obesity .....	28
Summary.....	30
Targeting Obesity in Young Adults .....	30
Life Course Perspective.....	31



Young Adulthood .....	31
Research in Young Adults.....	32
Education and Health .....	33
Summary.....	34
Technology-Based Health Promotion for Obesity .....	34
Smartphone Use.....	35
Smartphone Applications as Health Promotion Tools .....	36
Current Research on Apps for Health Promotion.....	37
Summary.....	41
Wearable Activity Trackers as Health Promotion Tools.....	41
Current Research on Wearable Activity Trackers for Health Promotion.....	42
Summary.....	45
Literature Review Summary.....	45
Chapter 3: Methods .....	47
Study 1 Methods.....	47
Research Design .....	47
Theoretical Foundations .....	48
Question Path Development .....	50
Sampling Procedures .....	52
Data Collection.....	53
Data Analysis.....	55
Study 2 Methods.....	57
Research Design .....	57

Theoretical Foundations .....	58
Question Path Development .....	60
Sampling Procedures .....	61
Data Collection .....	62
Data Analysis.....	64
Chapter 4: Results.....	67
Manuscript 1: Conducting Online Qualitative Research with Young Adults: Lessons Learned and Recommendations for Researchers .....	67
Abstract.....	67
Introduction .....	68
Description of Studies .....	70
Recruitment of Participants .....	71
Data Collection.....	72
Lessons Learned .....	77
Conclusions .....	88
Manuscript 2: Wearable Activity Trackers & Social Identity in Young Adults .....	89
Abstract.....	89
Introduction .....	90
Methods .....	92
Results .....	96
Discussion.....	105
Manuscript 3: Wearable Activity Tracker Use in Young Adults: A Social Cognitive Theory Perspective .....	111

Abstract.....	111
Introduction .....	112
Methods .....	114
Results .....	118
Discussion.....	132
Chapter 5: Discussion.....	137
Purpose of the Research .....	137
Summary of Findings .....	138
Limitations.....	140
Recommendations for Researchers .....	141
Recommendations for Public Health Practice .....	142
Conclusions .....	143
References .....	144
Appendices .....	156
Appendix A: Study 1 Social Cognitive Theory Constructs, Definitions, and Example Questions .....	156
Appendix B: Study 1 Type of Questions, Purpose of the Question, and Example Questions .....	157
Appendix C: Study 1 Main Questions Linked to Research Questions.....	158
Appendix D: Study 1 Interview Question Path .....	159
Appendix E: Study 1 Recruitment Poster.....	164
Appendix F: Study 1 Online Recruitment Posting .....	165
Appendix G: Study 1 Demographic Questionnaire.....	166

Appendix H: Study 2 Social Cognitive Theory Constructs, Definitions, and Example Questions .....	167
Appendix I: Study 2 Type of Questions, Purpose of Questions, and Example Questions .....	168
Appendix J: Study 2 Main Questions Linked to Research Questions .....	169
Appendix K: Study 2 Interview Question Path .....	170
Appendix L: Study 2 Recruitment Poster .....	176
Appendix M: Study 2 Online Recruitment Posting .....	177
Appendix N: Study 2 Demographic Questionnaire .....	178

## **List of Tables**

Table 1: Checklist for Conducting Online Interviews.....	75
Table 2: Checklist for Online Recruitment and Interviews.....	80
Table 3: Participant Demographics (n=57) .....	98
Table 4: Participant Demographics (n=57) .....	120
Table 5: Participant Technology (n=57).....	121
Table 6: Social Cognitive Theory Constructs .....	122

## Abstract

**Background:** Young adulthood (18-29) is a critical time in the lifespan for the development of health behaviors. Wearable activity trackers are being adopted by young adults ahead of health promotion research. **Methods:** Semi-structured individual interviews were used to explore the experiences of young adult adopters of wearable activity trackers. Young adults (n=57) ages 18-29 were recruited using typical case and saturation sampling. College students (n=35) and straight-to-work (STW) young adults (n=22) were both interviewed. Interviews were recorded, transcribed, and analyzed using NVivo. **Results:** Most young adults reported little knowledge of the health benefits/risks associated with their health behavior, but high expectations as to how the wearable activity tracker would assist them in developing or maintaining a behavior. Self-regulatory aspects such as the self-monitoring, built-in goals, and feedback were seen as benefits. Many reported not setting goals independent of the device. Most reported increased self-efficacy as a result of their wearable activity tracker use, and viewed their device as positive non-judgmental support for their health behavior. Wearable activity trackers were also seen as valuable tools for impression management and allowed young adults to present more than one actual or aspirational social identity. Young adults reported that they signaled to the world that they were health conscious and active. Non-college educated young adults reported that wearable activity trackers portrayed them as modern and successful, while college students felt they appeared to others as techy and friendly. **Conclusions:** Wearable activity trackers have the potential to be an effective behavior change tool when used in conjunction with theory-based health promotion programming. Young adults are motivated to change or maintain

health behaviors, but may need some additional support related to their health knowledge, expectations, and goal setting. In addition, the identities that young adults associate with wearable activity trackers are important as identity can influence health behavior. Future research should consider these identity related issues as they may play a key role in adoption and use of these health tools.

## **Chapter 1: Introduction**

Obesity in the United States (US) is a serious issue that contributes to morbidity and mortality.<sup>1,2</sup> In 2015, every state in the nation had an obesity rate above 20%, and 22 states had obesity rates over 30%.<sup>1</sup> Currently statistics indicate that obesity affects 1 in 3 adults in the US, with approximately 30% of adults ages 20-39 falling under the classification of obese.<sup>1-3</sup> Obesity can result in numerous health consequences such as cardiovascular disease, type 2 diabetes, sleep apnea, liver and gallbladder issues, joint problems, and some types of cancer.<sup>3</sup> In addition obesity has a significant economic impact in the US due to issues such as healthcare costs and lost productivity. It is estimated that obesity related costs range between \$147 to \$210 billion annually in the US.<sup>1,3</sup>

Obesity is often associated with three specific behaviors 1) insufficient physical activity, 2) sedentary time, and 3) poor nutrition.<sup>2,3</sup> These three behaviors are often heavily targeted for obesity prevention programming. Despite these efforts obesity has continued to increase, and health promotion research and practice has responded by adopting new techniques for addressing this epidemic.<sup>3</sup> Currently health promotion is looking to more comprehensive approaches such as using the ecological model to target multiple levels of influence or the life course perspective to target obesity across the lifespan.<sup>4-6</sup>

Young adulthood is the time in the lifespan between the ages of 18-29.<sup>7</sup> During this time changes in living situations, responsibility, independence, and decision making occur whether the young adult is prepared for it or not.<sup>8</sup> This time in the lifespan has also been identified as a period in which health habits are developed and those habits



are typically maintained for the lifetime of the individual.<sup>7,8</sup> Young adults are typically segmented by education (i.e. college students, non-college educated young adults) rather than other key demographics, such as occupation and income, as young adulthood is a transitional time period where finances and occupations may change multiple times in a short period.<sup>8,9</sup> Of these two groups college students are often researched more due to the ease of recruiting in an institution. However, both segments should be considered as they may experience young adulthood differently resulting in different knowledge, influences, and beliefs which may impact health promotion programming designed for this time in the lifespan.

In addition, education is also associated with obesity in the US. For example, from 2007 to 2010 women 25 and older with less than a bachelor's degree were more likely to be obese (39% to 43%) than those with a bachelor's or higher (25%).<sup>3</sup> In 2015, around 33% of adults who did not graduate high school were obese while their counterparts who graduated from technical school or college had obesity levels around 21.5%.<sup>3</sup> This underscores the need to segment young adults based on education to ensure that research is accurately accounting for differences in the experience of both groups.

Technology-based health promotion efforts are a promising avenue for obesity prevention programming aimed at young adults. Young adults are considered to be “digital natives” as they have been using technology their entire lives, and often turn to technology for information and assistance.<sup>10-12</sup> In particular, health and fitness related smartphone applications (apps) and newer wearable technology such as activity trackers are gaining popularity with young adults ahead of the research in this area. Researchers

have attempted to create and design interventions with health and fitness apps, but this has occurred with little success likely due to the limited knowledge available about how young adults actually use these tools.<sup>13-16</sup> More recently researchers have moved to exploring adoption and use of health and fitness apps, but there is still little research exploring use of these technologies within different segments of the population, such as young adults. The few studies that have explored adoption and use have primarily been conducted with college students.<sup>17-19</sup> This highlights a gap in research that explores existing use of commercially available health and fitness apps in young adults that are not college students. Beyond smartphone applications, there is little information on how young adults are using other types of technology to improve health. Wearable activity tracker research is in its infancy and little beyond validation studies has been done.<sup>20,21</sup> A few interventions have attempted to examine Fitbit activity trackers, but the studies have reported mixed results.<sup>22,23</sup> Again, this indicates a gap in the literature where formative research that explores preferences, influences, beliefs, and other vital information for developing successful health promotion programming is not present. The studies proposed here will address some of these gaps through qualitative methods.

### **Purpose of Studies**

The two studies will each fulfill a primary aim of this research. The primary aim of Study 1 is to qualitatively explore commercially available health and fitness application and wearable activity tracker use in non-college educated young adults (ages 18-29). The primary aim of Study 2 is to qualitatively explore commercially available wearable activity tracker use in college students (ages 18-25).

### ***Research Questions: Study 1***

#### ***Research Question 1:***

What influences non-college educated young adult use of commercially available health and fitness applications and wearable activity trackers?

#### ***Research Question 2:***

What social meanings do commercially available health and fitness applications and wearable activity trackers have for non-college educated young adults?

#### ***Research Question 3:***

How does using a commercially available health and fitness application and wearable activity tracker influence behavior in non-college educated young adults?

### ***Research Questions: Study 2***

#### ***Research Question 1:***

What influences college student young adults to engage in the use of commercially available wearable activity trackers?

#### ***Research Question 2:***

What social meanings do commercially available wearable activity trackers have for college student young adults?

#### ***Research Question 3:***

How does using a commercially available wearable activity tracker influence behavior in college student young adults?

### **Hypotheses**

Qualitative research avoids generating hypotheses both to reduce the chance of biasing the findings of the research and as a condition of the grounded theory

process.<sup>24,25</sup> This practice is done in part because the researcher is also the data collection instrument and going into an interview with a strong preconceived notion about what a participant may think, know, or feel might lead the interviewer to unintentionally lead the participant when questioning.<sup>24,25</sup> However, scholars in this area recommend stating if the researcher has any strong beliefs about what is likely to be found in the data.<sup>24-26</sup> By stating strong beliefs up front through hypotheses, the research audience has been alerted to any potentially biasing beliefs of the researcher who is also the data collection instrument. This can often be seen in studies that are reporting on topics with extensive research literature. In this instance, the research in the areas of focus for this series of studies is limited (e.g. there are no studies that have focused on non-college educated young adults and apps and no studies that have qualitatively explored wearable activity tracker use). Because of the potential for bias and the fact that there is no previous research that might have provided information that would lead to a hypothesis about the results of this research, no hypotheses were generated. While we did not have *strong beliefs* about what would be found in the data, there are some potential themes that we believed could be present prior to data collection. In particular, young adults may have a complex relationship with technology which may mean that they have different feelings, beliefs, and habits than we may assume when it comes to using technology as a part of health promotion. While we believed these themes were likely to come up, we did not develop this notion any further because of our use of grounded theory and because the first author was the data collection tool and did not want to be biased by exploring any ideas in detail. We have provided below a brief set

of examples that highlight why we believed that researching technology based health promotion must include more than simply the practical aspects of the technology.

### **Significance of the Research**

Young adults today are considered to be “digital natives” because they have never experienced a time where they were not utilizing technology in their everyday activities, and technologies such as smartphones and computers are often seen as an extension of their person.<sup>11,12</sup> For example, digital natives report online sources as their preferred option for information sourcing, and tend to use their phone for this process before using other technology.<sup>27</sup> In addition to its place in our lives as a tool, technology may also hold other meanings in our society, particularly for young adults. For example, some products may be seen as status symbols that represent desirable characteristics such as importance, uniqueness, or wealth. This means that owning a wearable activity tracker or health and fitness app may be less about the practical utility of the product and more about what owning it represents.<sup>28</sup> This type of conspicuous consumption has been explored by sociologists, economists, and marketing researchers for many years, and may be a primary motivator for the purchase and use of these products.<sup>29</sup> Young adults may also feel that these products project an image related to health or fitness that may be desirable, but this image may not align with their actual level of fitness or health. For example, young adults may be adopting these products as a way of developing an image as a “fit” person. What we do not know is if any of these reasons for adoption translate into actual changes in behavior or if this is just part of a cultural shift where consumption, wearing, and using fitness products are incorporated into everyday life. Furthermore, young adults may have simply integrated digital products

into their lifestyles to such an extent that they automatically turn to these products as part of their behavior change process prior to reaching for more traditional methods of behavior change.<sup>28,30</sup>

This complex relationship that young adults have with technology has not been thoroughly explored, but that has not stopped health promotion specialists from utilizing apps and activity trackers for research and programming. This practice is occurring despite the fact that little formative research has been conducted to understand how and if these technologies actually change behavior or how young adults actually use technology. Assumptions are being made that can impact how programs are delivered and how we interpret success or failure of these programs. From the little research that is available, health promotion specialists appear to be making these assumptions and these assumptions may be wrong or different from what young adults actually want. Before beginning to utilize these new and evolving technologies, a more thorough understanding of how digital natives use these devices to change health behaviors, what meanings they hold for young adults, and how health promotion can connect these technologies to meaningful theories and practices is needed. In the limited research available it is difficult to form solid conclusions about young adult preferences. For example, one study found that young adults did not feel that ease of use was an important feature of health and fitness apps, while another study found that it was one of the most important features.<sup>18,19</sup> Additionally, the studies that have attempted to use health and fitness apps created by researchers have not been successful, indicating that designing an app that is appealing to users is more complex than simply having theory-based or practical features.<sup>13,14,31,32</sup> Furthermore, even the interventions that have used

existing health and fitness apps and wearable activity trackers have had limited successes likely due to lack of formative research regarding this technology.<sup>22,33</sup> In light of this gap in the research, this series of studies aimed to understand these popular technologies that young adults have embraced by exploring why they have embraced these technologies, and how health promotion researchers and practitioners can *effectively* utilize these technologies for positive health behavior change.

Study 1 was a follow up to a preliminary study where qualitative methods were used to explore the preferences and habits of college student young adults who adopted and used commercially available health and fitness applications on their own.<sup>18</sup> This study extended the exploration of commercially available health and fitness apps to non-college educated young adults. In addition this study explored wearable activity tracker use in non-college educated young adults. This study is significant because to date there is no published qualitative research on the use of commercially available health and fitness applications or wearable activity trackers in non-college educated young adults. As educational attainment is associated with health behaviors and health outcomes it is important that research explores both college student and non-college educated young adult experiences to ensure a full understanding of this phenomenon.<sup>34,35</sup>

Study 2 was designed to qualitatively explore young adult college student use of commercially available wearable activity trackers. Wearable activity trackers are a growing segment of the health and fitness industry. Current research has examined if wearable activity trackers are reliable and valid measures of activity. Products that have been tested, such as the Fitbit, have proven to be reliable and valid measures of steps

and sleep activity.<sup>36-38</sup> This opens a door for utilization of devices that are commercially available and potentially less expensive to be used for health promotion research and practice, but young adults have not embraced activity trackers as quickly as adults ages 35-54.<sup>39</sup> Therefore, in order to understand if this group will adopt and use these products we must first explore the acceptability of these products for research and programming, the social meanings applied to these products, the impact these products have on behavior, and how young adults who currently utilize the products feel about their utility, features, and convenience. This will allow for the development of relevant and timely research and programming in this area.

### **Delimitations**

1. Young adult participants were ages 18-29 and not currently enrolled or graduated from college. (Study 1)
2. Young adult participants were ages 18-25 and currently enrolled as an undergraduate in college. (Study 2)
3. Participants had at least one commercially available health and fitness application related to fitness, nutrition, and/or weight maintenance on their smartphone or at least one commercially available wearable activity tracker. (Study 1)
4. Participants had at least one commercially available wearable activity tracker and its corresponding app on their phone. (Study 2)
5. Participants lived in the US. (Study 1 & 2)



## **Limitations**

1. Participants were volunteers and may be different from young adults who do not respond to recruitment efforts. (Study 1 & 2)
2. Participants were non-college educated young adults, and may be different from young adults who attend or attended college. (Study 1)
3. Participants were college student young adults, and may be different from young adult who do not attend or did not attend college. (Study 2)

## **Assumptions**

1. Participants were honest about their age and educational status during recruitment screenings. (Study 1 & 2)
2. Participants were honest about their use of at least one commercially available health and fitness application. (Study 1)
3. Participants were honest about their use of at least one commercially available wearable activity tracker and its corresponding app. (Study 1 & 2)
4. Participants answered demographic questionnaires honestly and accurately. (Study 1 & 2)
5. Participants were honest and forthcoming during interviews. (Study 1 & 2)

## **Operational Definitions**

1. Obesity – Obesity is defined as weight that is higher than what is considered as a healthy weight for a given height. Obesity is typically measured by using Body Mass Index (BMI). Obesity is defined in terms of BMI as having a BMI of 30 or higher.<sup>2</sup>

2. Young Adulthood –Young adulthood is defined as the time in the lifespan between the ages of 18-29. This time in the lifespan is characterized by a unique set of experiences, opportunities, and responsibilities that distinguishes it from adolescence and also adulthood. This time in the lifespan is considered important for the development of health habits.<sup>7,8</sup>
3. Commercially Available Health and Fitness Applications (Apps) – Applications that are commercially available for download to smartphones that are categorized under the heading of health and fitness (e.g. MyFitnessPal, Livestrong, MyPlate, Runkeeper)
4. Commercially Available Wearable Activity Trackers (also described as: activity monitors, fitness trackers, fitness monitors, wearables, smartwatches) – Devices that are worn on the body (typically the wrist) that are commercially available for purchase and have an app that links with the device to report activities such as steps, sleep, heart rate, and calories burned. They are often defined using the following criteria: 1) the device is designed to be worn on the user's body, 2) the device uses an accelerometer, altimeter, or other sensors to track the user's movements and/or biometric data, and 3) the device uploads activity data to an online application that shows trends over time.<sup>40</sup>

## **Chapter 2: Literature Review**

### **Obesity in the United States**

Obesity has steadily increased over the last 30 years, and continues to be a significant health issue.<sup>3</sup> In 2015, every state in the nation had an obesity rate above 20%, and 22 states had obesity rates over 30%.<sup>1</sup> Currently, statistics indicate that obesity affects 1 in 3 adults in the US, with approximately 30% of adults ages 20-39 falling under the classification of obese. This means that now the average US adult is more than 24 pounds heavier than in 1960.<sup>1</sup>

### ***Health Consequences of Obesity***

Obesity is currently seen as significant health threat and can result in numerous health consequences such as cardiovascular disease, type 2 diabetes, stroke, sleep apnea, liver and gallbladder issues, joint problems, mental health issues, and some types of cancer.<sup>3</sup> Cardiovascular disease is the leading cause of death in the US, and 1 in 4 US adults have some form of heart disease.<sup>1</sup> People who are obese are more likely to have hypertension, higher levels of triglycerides, and lower levels of low density lipoproteins (LDL), which are all risk factors for heart disease and stroke. In addition it is believed that 30% of hypertension cases are attributable to obesity.<sup>1</sup> More than 29 million adults in the US have diabetes and approximately 86 million have pre-diabetes.<sup>1,3</sup> It is the seventh leading cause of death in the US, and it is predicted that by 2050 one-third of US adults will have diabetes.<sup>1</sup> In addition to these two serious issues, up to 40% of certain forms of cancer (e.g. breast, liver) can be attributed to obesity, and 70% of individuals with arthritis are overweight or obese.<sup>1,3</sup> Furthermore, serious mental health

and cognitive issues (e.g. depression, dementia, Alzheimer's) have been associated with obesity.<sup>1</sup>

### ***Economic Consequences of Obesity***

Cardiovascular disease and type II diabetes alone account for serious economic consequences in the US. Around 1 of every 6 health care dollars is spent on cardiovascular disease.<sup>41</sup> Cardiovascular disease health care costs and lost productivity account for around \$320 billion annually.<sup>41</sup> Type II diabetes costs the US around \$245 billion in medical costs and lost productivity annually, while individuals with type II diabetes experience medical expenditures that are 2.3 times higher than those without diabetes.<sup>1</sup> These economic consequences of obesity not only impact individuals, but also the entire US economy. Estimates indicate that the United States' economy is impacted by obesity in the range of \$147 billion to \$210 billion in annual costs.<sup>1,3</sup>

### ***Demographic Differences in Obesity***

Differences in obesity rates can be seen based on age, sex, ethnicity, geographical region, and education level exemplifying that obesity is a dynamic and complex public health issue. For example, 31% of 12 to 19 year olds are obese, and 51% are overweight or obese.<sup>1</sup> Middle age adults (ages 40-59) have higher obesity rates (39.5%) than younger adults (ages 20-39) and adults over 60 (30.3% and 35.4% respectively).<sup>3</sup> Women over the age of 20 are more likely to have higher rates of obesity (36.1%) and extreme obesity (8.3%), than men (33.5% and 4.4%).<sup>1</sup> In addition obesity rates are higher among Black (47.8%) and Latino/a (43%) adults than in Whites (32.6%) and Asian Americans (10.8%).<sup>1,3</sup> Furthermore, geographically the 10 states with the highest obesity rates are all located in the southern and western US.<sup>1</sup> In terms

of education, from 2007 to 2010 women 25 and older with less than a bachelor's degree were more likely to be obese (39%-43%) than those with a bachelor's or higher (25%).<sup>3</sup> In 2015, around 33% of adults who did not graduate high school were obese while their counterparts who graduated from technical school or college had obesity levels around 21.5%.<sup>3</sup>

### ***Behaviors Associated with Obesity***

There are three primary health behaviors that are associated with obesity in the US: 1) insufficient physical activity, 2) sedentary time, and 3) poor nutrition. Each of these behaviors may independently contribute to the development of obesity or the health issues related to obesity. For example, not regularly meeting current physical activity recommendations (i.e. not getting 150 minutes per week of moderate physical activity) is associated with 1 in 10 deaths in the US.<sup>1</sup> Over 32% of adults report that they engage in no leisure time physical activity, and of those that do engage in physical activity 80% report that they do not meet the US aerobic and strengthening activity guidelines for adults.<sup>1,42</sup> Despite the link between physical inactivity and obesity, 60% of adults in the US are not even active enough to receive any health benefits.<sup>1,43</sup> Women report higher levels of physical inactivity than men and this gap increases with age.<sup>42</sup> In addition Black (41.1%) and Latino/a (42.2%) adults are more likely to be inactive than White adults (27.7%).<sup>42</sup> Furthermore, physical inactivity is inversely associated with education with those without a high school diploma reporting the highest levels of inactivity followed by those with a high school diploma, then some college, and finally the lowest levels of inactivity are seen in those with a college degree or higher.<sup>42</sup> In addition, sedentary time is often discussed in conjunction with physical inactivity, but is

defined as a distinct behavior separate from physical inactivity. Sedentary behavior has most recently been defined as any waking behavior characterized by an energy expenditure of less than 1.5 METs, while in a sitting or reclining posture.<sup>44</sup> Sedentary time has also been established as an independent risk factor for issues such as obesity, cardiovascular disease, and diabetes.<sup>45,46</sup> US adults spend around 7.7 hours or approximately 55% of their waking hours engaged in sedentary behaviors.<sup>47</sup> In terms of age differences, young people ages 16-19 spend about 8 hours of their day in sedentary behaviors, while those ages 20-29 spend approximately 7.5 hours per day sedentary. These statistics differ slightly by sex with women ages 16-19 engaging in sedentary behaviors around 59% of their day, while men this age only engage in these behaviors around 56% of their day. In those between the ages of 20-29 women again spend more of their day in sedentary time than men (7.68 hours vs. 7.27 hours).<sup>47</sup> In terms of ethnicity Mexican Americans ages 16-19 and ages 20-39 engage in less sedentary behavior than Whites and Blacks of the same ages. Furthermore, poor nutrition is also associated with obesity and the health consequences of obesity. Poor nutrition such as not consuming enough fruits and vegetables or over-consuming foods high in sugar, salt, and fat can contribute to the development of obesity, cardiovascular disease, type 2 diabetes, and other health issues.<sup>48</sup> In general the typical US diet exceeds the recommended intake levels for added sugars, refined grains, sodium, and saturated fats.<sup>49</sup> In addition the national average for regular produce consumption is only at 57.7%, while 40% of daily calories for children and adults come from added sugars and solid fats.<sup>49</sup> Only 21% of US adults consume the recommended amount of fruits per day and only one-third consume the recommended amount of vegetables.<sup>3</sup>

## ***Summary***

In sum, obesity is as serious problem in the US and little progress has been made to reduce obesity rates that have climbed to over 20% for each state in the nation over the past 30 years.<sup>3</sup> Obesity can result in a number of health issues such as cardiovascular disease, type 2 diabetes, stroke, sleep apnea, liver and gallbladder disease, and some types of cancer.<sup>1,2</sup> Obesity also impacts the US economy due to increased healthcare costs and lost productivity with the estimated annual cost between \$147 to 210 billion.<sup>1,2</sup> In addition differences in obesity rates can be seen based on age, sex, ethnicity, geographical region, and education level. Finally, three behaviors (physical inactivity, sedentary time, and poor nutrition) have been associated with obesity.<sup>2</sup> This research on obesity shows that obesity in the US is a complex issue with a number of influences that must be accounted for when considering how to develop successful health promotion programming.

## **Targeting Obesity in Young Adults**

A number of strategies for targeting obesity are present in the literature. Many health promotion practitioners and researchers have focused on behavioral interventions and health communication campaigns intended to change the previously discussed health behaviors of adults.<sup>50,51</sup> Others have focused efforts on children and adolescents, with many indicating that prevention efforts should emphasize young people rather than adults.<sup>52,53</sup> Still other interventions have focused obesity reduction efforts on those already experiencing the health consequences of obesity.<sup>54,55</sup> Despite these efforts obesity has continued to increase, and health promotion research and practice has responded by adopting new techniques for addressing this epidemic.<sup>3</sup> Currently health

promotion is looking to more comprehensive approaches, such as using the ecological model to target multiple levels of influence and the life course perspective to target obesity across the lifespan.<sup>4-6</sup>

### ***Life Course Perspective***

In recent years a strategy for targeting obesity has been to explore obesity and its many influences across the lifespan or by using a life course perspective. A life course perspective relies on a multidisciplinary framework for understanding how early and later life biological, behavioral, social, and psychological exposures affect health.<sup>56</sup> It proposes that prevention efforts should be focused on multiple times during the lifespan rather than a single period. A life course perspective also proposes that there are developmental periods in each person's life where health behaviors may be more important than in other times.<sup>57,58</sup> Understanding which times during the lifespan are important in terms of the development of obesity can provide guidance to researchers and practitioners looking to target obesity. For example, dietary habits in adulthood may be established in early life, but may impact health in later adulthood.<sup>56</sup>

### ***Young Adulthood***

Young adulthood (18-29 years old) is an important developmental period especially in terms of the establishment of health behaviors.<sup>7-9,59</sup> Young adulthood is also marked by demographic changes that may create significant personal instability.<sup>8</sup> For example, during this time in the lifespan young adults may experience diverse living situations, cycles of college attendance, moving into and out of the workforce, marriage, and parenthood. These changes are all marked by increasing responsibility, independence, and decision making.<sup>7,8</sup> These can also be seen in the development and



maintenance of personal habits that impact obesity, such as physical activity, sedentary time, and nutrition. The positive or negative health habits that are adopted during this time in the lifespan are likely to be maintained into adulthood.<sup>8</sup> For example, if a person develops a habit of sitting for long periods of time, then this sedentary behavior may be maintained for rest of the person's life. In addition these habits may have a significant impact on the development of health issues such as cardiovascular disease and diabetes. For example, excessive sedentary time can result in physiological changes that contribute to the development of atherosclerosis which may begin in young adulthood and remain asymptomatic until later in life.<sup>60</sup>

### ***Research in Young Adults***

Young adults may experience a number of influences during this time that range from the interpersonal influences (e.g. parental guidance or lack thereof) to social influences (e.g. positive or negative media displays) that impact their health behaviors.<sup>4</sup> In order to successfully target these health behaviors, we must first understand the underlying motivations, beliefs, influences, and knowledge of the groups we are attempting to target. One way that this is accomplished is by segmenting or dividing young adults based on important demographic characteristics that may influence health behaviors such as education, income, occupation, or marital status.<sup>8</sup>

Young adults are typically segmented by education (e.g. college students, non-college educated young adults) rather than other key demographics, such as occupation and income as young adulthood is a transitional time period.<sup>8,9</sup> For many young adults this time period is marked by constant change that moves them in and out of different demographics (sometimes several times) before they are settled into a more stable

demographic profile.<sup>8,9</sup> For example, in terms of income many young adults may be working part time while in college, but getting financial support from parents. Therefore their income may not accurately represent their actual financial circumstances, and may not provide the most appropriate demographic profile of that young adult.

### ***Education and Health***

Segmenting young adults by education is also useful because educational attainment is considered one of the strongest and most consistent predictors of health and mortality in the US.<sup>34,61</sup> Education is likely to impact health through both psychosocial and material mechanisms.<sup>35</sup> For example, higher education may provide general gains in knowledge and reasoning skills or interpersonal relationships that may aid in the prevention of disease. For example, higher educated individuals may have the knowledge or skills to better search for credible health information or they may have built a broader network where they can access health information interpersonally. Education may also increase job opportunities, prestige, power, and financial security.<sup>35</sup>

Education has also been extensively explored in terms of its association with obesity. For example, obesity rates among better educated people are approximately half those of lower educated individuals, and one report found that each additional year of education beyond secondary school reduces the probability of being obese by 1.4 percent.<sup>62</sup> In addition the same study observed that obesity declines rapidly for people with more than 12 years of education.<sup>62</sup> Education may also influence health behaviors related to obesity. One study found that nearly half of deaths in the US are a result of behavioral factors such as smoking, diet/exercise, and alcohol consumption.<sup>63</sup> In addition, another study indicates that more educated people engage in more preventive

and risk reducing behaviors.<sup>62</sup> This study suggests that better educated people have more: access to resources, general knowledge, behavior specific knowledge, and even cognitive abilities that impact their health behaviors in a positive way leading to better health outcomes.<sup>62</sup>

### ***Summary***

In sum, exploring obesity and the behaviors associated with obesity in young adulthood is essential as this time in the lifespan and is considered important for the development of health habits that impact obesity and the health issues associated with obesity.<sup>7,8</sup> In addition segmenting young adults into two groups 1) college students, and 2) non-college educated young adults is important to developing a better understanding of the knowledge, influences, and beliefs of young adults by education level as education has been associated with reduced obesity and more positive health behaviors.<sup>62</sup>

### **Technology-Based Health Promotion for Obesity**

Technology used in obesity prevention efforts is a growing trend, especially for young adults as they are lifetime users of technology.<sup>10,11,64</sup> The Internet and text messaging have both been used for chronic disease management, health promotion interventions, and as a method to connect with program participants.<sup>65-67</sup> For example, one study targeted college students through an intervention that used online lessons to promote fruit and vegetable consumption.<sup>65</sup> Other studies have used tailored text messaging to deliver interventions related to physical activity, weight loss, and nutrition.<sup>68</sup> Newer technology such as smartphone applications (apps), social media, and wearable activity trackers are beginning to be tested as potential tools for behavior

change.<sup>69-71</sup> For example, one study used online content posted to a social media site to engage participants in physical activity through interactions with other participants.<sup>69</sup> Another study used a popular commercially available smartphone app to help overweight primary care patients track calorie intake.<sup>72</sup> Finally, an additional study utilized Fitbit wearable activity trackers for increasing physical activity in youth.<sup>22</sup> Since this research is focused on the newer technologies the remainder of the literature review will focus on these last two technology examples: 1) commercially available health and fitness applications, and 2) commercially available wearable activity trackers.

### ***Smartphone Use***

Approximately 85% of young adults own a smartphone, regardless of income.<sup>73</sup> Sixty-two percent of adults have used their smartphone to get information about a health condition, and this does not vary significantly for those in low income households (63% in < \$30,000 households) versus high income households (59% in \$75,000+ households). Young adults rely heavily on their smartphones for health information with 77% reporting that they used their phone in the last year to acquire information about a health condition.<sup>73</sup> Not only do young adults make up the largest share of smartphone users, but this is their preferred method of information seeking and communication.<sup>10,11</sup> While the majority of young adults own and are using smartphones, approximately 23% of lower income and minority smartphone owners have had to at some point cancel or suspend phone services, and younger smartphone owners are more likely to have done this compared to adults older than thirty.<sup>73</sup> This can cause complications for health promotion programming and research that aims to use

smartphones. However, this issue should be explored further before reverting back to non-technology based techniques because despite these complications, smartphones may still be one of the best ways to connect with a broad range of young adults. This is the technology that they prefer, are using the most, and that they may have more access to than other forms of communication.<sup>64,74</sup>

### ***Smartphone Applications as Health Promotion Tools***

Commercially available smartphone applications or “apps” are a logical choice for research and practice as they are typically low cost, user-friendly, and information logged into and stored on the apps can easily be accessed for research and monitoring purposes. Perhaps more importantly health and fitness apps are gaining popularity in the US with approximately 19% of all smartphone owners and 24% of young adults reporting that they own and use at least one health and fitness app.<sup>75</sup> Approximately 38% of health and fitness app owners report using an app to track their exercise, 31% report using an app to monitor their diet, and 12% report using an app to manage their weight.<sup>75</sup> The fact that health and fitness apps are popular in the US makes them a potentially useful tool for health promotion as they are already being adopted and used by young adults. In addition a review of technology-based obesity interventions found that apps were described as the ideal tool for obesity interventions due to their accessibility, reach, and ability to deliver customized and interactive programming.<sup>76</sup> Additional research indicates that technology-related programming has seen success in segments of the population with low health literacy, which would indicate that even young adults without considerable health knowledge could be positively impacted by interventions using apps.<sup>77,78</sup>

### ***Current Research on Apps for Health Promotion***

To date the research on apps used in health promotion is limited. There are three primary areas where published research has focused: 1) development of apps, 2) interventions using apps, and 3) adoption and use of commercially available health and fitness apps.

#### ***Development of Apps***

A few researchers have attempted to create and use their own apps for health promotion research and practice purposes.<sup>13,14,31,32</sup> Most often health promotion apps were created and tested, and found to be ineffective or too costly to maintain and use. App creation requires a significant amount of resources, expertise, and time that health promotion researchers and practitioners often do not have. Even when all of these are available competing with commercially available apps that offer more features, little to no cost, and ease of use is not really an option for most researchers and practitioners. For example one study found in interviews with users during pilot testing that the app had issues with design, feedback, navigation, and terminology.<sup>13</sup> Another study found that the rapid evolution of this type of technology rendered their app in need of an update before the study's pilot testing had ended, and that maintaining the app proved to be time consuming and out of the reach of their projected budget.<sup>14</sup> A third study found that the lack of appealing interactive components and limited institutional financial support restricted the options for a health app created for college students.<sup>31</sup>

#### ***Interventions Using Apps***

In recent years researchers have also explored the use of apps for interventions focused on obesity and/or the chronic diseases related to obesity. Most interventions

have focused on using apps designed for clinical purposes.<sup>15,79-81</sup> For example, one study used a suite of apps (HealthReachMobile) designed to help patients with type 2 diabetes understand blood glucose monitoring.<sup>15</sup> Another study used the Nutricam program, which photographs a meal and then sends data to dietitians for analysis of the meal.<sup>79</sup> Additionally, another study used an app to monitor dietary intake, body weight, and to objectively measure physical activity obtained from a Bluetooth-enabled accelerometer.<sup>80</sup>

In addition to apps designed for clinical purposes several studies have also utilized commercially available apps for interventions.<sup>16,33,72</sup> For example a weight loss study conducted in 2014 used MyFitnessPal, a popular commercially available health and fitness app, as the primary intervention for a group of overweight and obese primary care patients looking to lose weight. There was no significant weight change in either the intervention or control group. The study also found that most participants did not use the app regularly, and even in those that did decreased use over the course of the study.<sup>72</sup> Another example comes from a study that used a behavioral intervention delivered using the LoseIt! App (i.e. food diary app).<sup>33</sup> This intervention used four groups. The first group used intensive counseling focused on decreasing calorie intake following the DASH dietary recommendations, setting a goal of 5% weight loss, and getting at least 150 minutes of moderate intensity physical activity a day. The second group used intensive counseling and the LoseIt! app, the third group used less intensive counseling and the app, and the fourth group only used the app. There was no statistically significant weight loss in any group, but the intensive counseling plus LoseIt! app group lost the most weight indicating that this option could be a potentially

feasible weight loss intervention with some adjustments such as the addition of a physical activity tracking option.<sup>33</sup>

#### *Adoption and Use of Commercially Available Apps*

The majority of the research on apps has focused on the adoption and use of commercially available apps.<sup>17-19,82,83</sup> This is because, as evidenced in the two previous sections, creation of apps by health promotions specialists is likely not a feasible option without significant technical expertise and funding. In addition interventions have produced mostly insignificant results. This is likely due to not having a solid research foundation to allow for an appropriate understanding of how to utilize apps effectively in health promotion efforts. These issues are likely the reason that the research in this area has shifted back to exploring how commercially available apps can be utilized for health promotion research and practice.

To date most of the research on adoption and use has utilized a structure that does not explore existing adoption and use, but rather focuses on providing research participants with predetermined apps or examples of features from apps and asking a series of questions to obtain information about preferences.<sup>17,19,82,83</sup> For example, one study evaluated reasons for adopting health apps through 2 main predictors, perceived usefulness and perceived ease of use. The participants were not current app users, but were provided with instructions for evaluating two preselected existing apps. Then they were given a survey that measured perceived usefulness, perceived ease of use, intention to use health apps, and other items related to the model used. The results indicated that perceived usefulness impacted the intention to use a health app, but perceived ease of use did not.<sup>19</sup> An additional study used qualitative methods to explore



this issue, but again this was not conducted with current app users. This study used focus groups to explore adults' perceptions of health apps. Participants were provided with examples of particular features and reported their thoughts and feelings regarding the example features. They then reported on how they felt about the accuracy, legitimacy, security, effort required, and effects on mood of the app features.<sup>17</sup> This practice of assigning researcher selected apps to participants unfortunately creates an artificial situation where user choices, experiences, and perceptions of the apps are overlooked for researcher convenience and control.

### *Preliminary Study*

In order to better understand these key factors that influence adoption and use of these products research needs to focus on exploring existing use of these products. To this end a preliminary study was conducted with college student users of commercially available health and fitness applications.<sup>18</sup> This study recruited college students, who were currently using a commercially available health and fitness application on their own, to participate in interviews about their experiences with the app. They were asked questions about how they chose the app, what features were important to them, and whether or not the app had actually caused a change in their behavior. The study found that participants felt strongly about certain aspects of the app such as ease of use, cost, and having interactive features including visual and auditory cues and/or game like rewards and challenges. The interviews also found that there were two groups of users: 1) those who adopted the app as a way to change their behavior, and 2) those who adopted the app as a way to maintain a current behavior. While this preliminary study provides useful information about college student preferences, use, and behaviors

regarding commercially available health and fitness applications more research needs to be conducted in this area to explore adoption and use of these products by different segments of the population and the specific meanings and purposes that each segment applies to these products.

### ***Summary***

In sum, research on health and fitness apps has focused on three primary areas of interest: 1) creation of apps, 2) interventions using apps, and 3) adoption and use of commercially available apps. The research on creation of apps indicates that a better direction for health promotion is to pursue existing commercial health and fitness apps as they are technically and financially more feasible to use. The intervention research indicates that using commercially available apps may be possible, but more formative research on these products needs to be conducted prior to using them in interventions. Finally, research on the adoption and use of commercially available health and fitness apps is beginning to provide a picture of the features and options for health promotion specialists, but more research needs to be conducted to fully understand their potential as behavior change tools.

### **Wearable Activity Trackers as Health Promotion Tools**

Over the last few years wearable activity trackers have become popular in the US. The wearable activity tracker industry is currently valued at around \$2 billion, with that number projected to rise to \$5 billion by 2019.<sup>84</sup> These devices are often referred to as wearables, activity trackers, activity monitors, fitness trackers, or smartwatches. Just as there are a number of names for these devices, there are also a number of definitions for what qualifies a device to be a wearable activity tracker. Most recently they have

been defined using the following criteria: 1) the device is designed to be worn on the user's body; 2) the device uses an accelerometer, altimeter, or other sensors to track the user's movements and/or biometric data; and 3) the device uploads activity data to an online application that shows trends over time.<sup>40</sup>

Approximately 30% of US consumers across demographic groups report owning wearable technology, such as fitness trackers and smartwatches, and 80% of Americans report that they are aware of these devices.<sup>84,85</sup> Young adults are 55% more likely to own wearable technology than adults 35 and over, and 51% of young adults said they were likely to purchase a wearable activity tracker in the form of a fitness band in the next year.<sup>85</sup> The top three types of information that US consumers report wanting from wearable devices are all health related. Seventy-seven percent indicated they want wearable devices to help them exercise better, while 75% want them to collect and track medical information, and 67% want them to help them eat better.<sup>85</sup> Similar to patterns with health and fitness apps, wearable activity trackers are being adopted by young adults ahead of health promotion research and directed efforts to utilize them in a way that could ensure maintained use.

### ***Current Research on Wearable Activity Trackers for Health Promotion***

Current research on wearable activity trackers is limited. The research that has been conducted has focused primarily on two areas 1) reliability and validity of wearable activity trackers, and 2) interventions using wearable activity trackers.

#### ***Reliability and Validity of Wearable Activity Trackers***

In terms of the reliability and validity of these devices there have been several studies that have focused on wearable activity trackers as being potentially useful to

tracking steps, sleep, distance, and energy expenditure.<sup>20,21,86,87</sup> One study examined multiple commercially available wearable activity trackers such as Fitbit zip, Fitbit one, Jawbone UP, Nike+fuelband, and Misfit Shine in free living conditions (e.g. participants used the wearable activity trackers while conducting their daily activities) for 24 hours. This study found that these products were highly accurate in measurement of steps and sleep quantity, but that measures of energy expenditure and moderate to vigorous physical activity only demonstrated moderate to strong correlations with the research grade accelerometers.<sup>87</sup> Another group examined commercially available wearable activity trackers including: Fitbit Flex, Jawbone UP, Nike+fuelband SE, Misfit Shine, Withings Pulse, and Fitbit Zip. This study found that Fitbit Flex, Jawbone UP, Misfit Shine, Withings Pulse, and Fitbit Zip all demonstrated reliability. Of these reliable wearable activity trackers Jawbone UP, Misfit Shine, Withings Pulse, and Fitbit Zip all demonstrated validity in laboratory conditions (e.g. walking on a treadmill).<sup>21</sup> Knowing if these products are reliable and valid can aid in their use in research that is monitoring physical activity. In particular it seems that at this point these products may prove to be the most useful for studies focused on steps and sleep. However, new generations of the devices that were tested and new products from other brands have already entered the market and now these tests need to be conducted again with these new devices to determine if they may be useful for other areas of research such as energy expenditure and distance.

#### *Interventions Using Activity Trackers*

The Fitbit, in particular, has also been tested for use in two interventions with mixed results.<sup>22,23</sup> These interventions have primarily looked at Fitbit as source of

motivation, self-regulation, and monitoring for participants that are attempting to increase their physical activity. For example, a physical activity intervention in postmenopausal women explored integrating a Fitbit into the intervention with a focus on increasing self-monitoring and self-regulation skills.<sup>23</sup> They found that participants experienced few barriers and technical issues, and that participants wore the trackers consistently and also looked at feedback regularly. Most participants reported that they found that Fitbit to be helpful for increasing their physical activity, and the Fitbit group increased their moderate physical activity by 62 minutes per week.<sup>23</sup> Another study used the Fitbit One to encourage physical activity in low income middle school students.<sup>22</sup> This study found that while the initial interest in the Fitbit increased physical activity, the initial increase did not last. Participants indicated that they did feel motivated by the device and some indicated that the tracker did increase their physical activity. An issue was that the Fitbit used in this study was a clip on device rather than the newer generation bands and students disliked this product due to fears of losing it and comfort issues related to it being a clip on device.<sup>22</sup>

In sum, the research on wearable activity trackers, which is limited at this point, is similar to the research on health and fitness apps. While research on these products for health promotion purposes is limited what is known is that these products are being purchased by the general public. This means that there is critical need to conduct formative research in this area to determine if these products may hold a value to health promotion research and practice. In particular research that can provide insight into adoption, patterns of use, and social meanings of these products may aid in determining if wearable activity trackers are appropriate for health promotion research and practice.

If these products prove to be useful then health promotion practitioners and researchers may be able to incorporate them into meaningful health promotion interventions.

### ***Summary***

In sum, technologies such as smartphone applications and wearable activity trackers are gaining popularity ahead of research in this area. Some health promotion specialists are even choosing to use these technologies in programming ahead of formative research that can aid in explaining the preferences, influences, and beliefs of young adults when it comes to these technologies. More research is needed to help health promoters understand how these technologies fit into health promotion programming and if they are effective behavior change tools.

### **Literature Review Summary**

Obesity rates in the US are high with 1 in 3 adults suffering from obesity and approximately 30% of younger adults (ages 20-39) experiencing obesity and the health consequences that often accompany it.<sup>1,3</sup> The potential health consequences of obesity are serious. Cardiovascular disease and type II diabetes are two of the leading causes of morbidity and mortality in the US and both are associated with obesity.<sup>1,3</sup> In addition the billions of dollars in health care costs, lost productivity, and lost wages associated with obesity not only hurt individuals and families, but also impact the US economy negatively.<sup>1,3</sup> Obesity is a complex issue with many demographic differences and it is often associated with three specific behaviors: 1) physical inactivity, 2) sedentary time, and 3) poor nutrition. Researchers and health promotion specialists often segment the population based on key demographic characteristics such as age and education and these behaviors are generally targeted for health promotion efforts and research related

to obesity prevention. These are important factors to consider as health promotion efforts that are tailored to more specific populations such as young adults are more likely to produce positive results. In addition, education level has been consistently associated with obesity and should be considered when segmenting the young adult population.<sup>62</sup> Finally targeting these behaviors in young adults through technology-based health promotion programming may provide a new avenue for health promotion researchers and practitioners. In particular, smartphone and wearable technologies are gaining popularity with this segment of the population and should be explored for use as health promotion tools.<sup>11</sup>

## **Chapter 3: Methods**

The following methods section separately outlines the methods used in both studies. The primary purpose of Study 1 is to qualitatively explore the use of commercially available health and fitness apps and wearable activity trackers in non-college educated young adults (ages 18-29). The primary purpose of Study 2 is to qualitatively explore the use of commercially available wearable activity trackers in college student young adults (ages 18-25).

### **Study 1 Methods**

#### ***Research Design***

In order to develop effective interventions health promotion practitioners must first have an in-depth understanding of the knowledge, influences, and behaviors of the specific population they are trying to reach. In attempting to gain in-depth information qualitative inquiry allows for researchers to carefully plan and execute research that explores why certain groups adopt health behaviors and/or continue these behaviors once they have adopted them.<sup>24,25,88</sup> This provides researchers with the ability to reveal unexpected motivations or beliefs as it elicits unique and intimate knowledge about the research participants. The results can then be used to inform additional research and/or to design targeted effective intervention strategies for specific behaviors.

This project used the qualitative approach of individual interviews to explore commercially available health and fitness application (app) and wearable activity tracker use in non-college educated young adults. Interviews are an ideal data collection tool for this topic and this segment of the population for several reasons. The first is that interviews provide the opportunity to establish a one-on-one connection between the



participant and the interviewer and can lead to more detailed description of personal health behaviors.<sup>24</sup> Secondly, conducting individual interviews rather than focus groups allows for young adults to feel comfortable discussing what can be sensitive subjects such as weight gain, obesity, nutrition habits, and physical inactivity. Finally conducting individual interviews allows for the questions to be tailored to the individual's health behavior, which provides a simple way to capture the participant's personal experiences with his/her particular behavior.

### ***Theoretical Foundations***

This study was developed through a systematic process and was guided by the Pragmatic Theory of Truth (Pragmatism), Social Cognitive Theory (SCT), and a review of the established literature in this area.<sup>24,89</sup> Pragmatism provided the qualitative theoretical foundation of this study. Pragmatism is focused on discovering the practical implications of a certain phenomenon, and in particular how findings can be applied to addressing concrete issues and problems.<sup>24</sup> Pragmatism is aimed at seeking practical and useful answers that can potentially solve or provide direction on how to address health issues. The use of commercially available health and fitness apps and wearable activity trackers is an emerging behavior and researching this phenomenon can provide valuable insights into these products and the people who use them. The use of pragmatism as the foundation of this study allowed for the research to gather timely and actionable information about this emerging behavior.<sup>24</sup> As health promotion is ultimately a field that is looking to change behavior the goal of this work was to add to the practical information available to health promotion specialists who want to use commercially available health and fitness apps or wearable activity trackers for

behavior change in research and/or practice. The commercial availability and popularity of these technologies increases the urgency in which health promotion specialists need to gain information about these products as adoption by young adults is occurring rapidly and with little support from health promotion professionals. With a pragmatic approach to the research this study was able to gather timely and useful information about a growing trend in young adult health and fitness. This allows health promotion efforts to be acceptable and relevant to the populations we are trying to reach. Some examples of the questions that were answered by using a pragmatic approach are: 1) why are young adults adopting commercially available health and fitness applications and wearable activity trackers on their own, and 2) what features were utilized by young adults who have successfully used a commercially available health and fitness application or wearable activity trackers to change or maintain a behavior?

In addition to the pragmatic foundation of this study an established health promotion theory was used to guide the development of interview questions. This was to aid in answering important questions that health promotion specialists can utilize in research and practice. Social Cognitive Theory (SCT) was created by Albert Bandura in 1986.<sup>4</sup> This theory has been shown to be a practical and successful theory for behavior change related to physical activity and nutrition.<sup>89</sup> In addition, Bandura has outlined how this theory can be utilized for health promotion purposes and even defines the constructs in the theory that best fit with health promotion activities.<sup>89</sup> It is these constructs (i.e. knowledge, self-efficacy, outcome expectations, self-regulation, and facilitators/barriers) and their definitions that were used to guide multiple questions in the interview question path. As all the participants that were recruited for this study

were already attempting to change or maintain their target behavior by using commercially available health and fitness apps or wearable activity trackers this theory was a logical and useful choice. By asking participants several questions that were guided by SCT this study was able to capture what features of the apps/trackers were related to the established behavior change techniques of this theory, and which of these features were assisting participants most with behavior change. This information can provide health promotion specialists with a theoretical foundation that can be utilized to strengthen programming created for use with these types of products. See Appendix A for Study 1 questions guided by SCT.

### ***Question Path Development***

The development of the interview question path was an iterative process. The first step was to consider what questions should be asked based on the theoretical foundations of the study and a review of the literature. The next step was to ensure that the questions were aimed at answering one of the research questions. The final step was to determine the order of the questions that were asked. Typically broad questions or main questions are asked, followed by more specific questions or follow-up questions, and then finally probes were used to encourage participants to provide details that would elicit the most in-depth responses possible.<sup>25</sup> In addition to the ordering of the questions the format or the way a question is asked is also an important step in developing the interview question path. There are four primary types of questions: 1) experience/behavior, 2) knowledge, 3) opinion/value, and 4) feeling.<sup>25</sup> Experience/behavior questions focus on allowing the participant to describe past and present experiences, behaviors, actions, and activities.<sup>25</sup> Knowledge questions focus on

discovering what participants see as factual information regarding the phenomenon being explored.<sup>25</sup> Both of these types of questions are often asked as main or follow up questions as they are less likely to require significant contemplation or self-examination on the part of the participant. Opinion/value questions focus on how participants interpret specific events and often ask participants to reflect on decision making processes.<sup>25</sup> These questions may assist the researcher in revealing goals, opinions, norms, intentions, desires, and values of the participants. Feelings questions focus on emotional responses to the phenomenon of interest.<sup>25</sup> Opinion/value and feelings questions are often asked as follow-ups or probes and may require multiple probes to allow the participant time to contemplate the question being asked. Employing a variety of question types allowed for a more thorough exploration of the topic and offered a way to capture information that simply asking one type of question would not accomplish. See Appendices B and C for Study 1 example questions.

Once the process of developing the interview question path was completed the question path was then tested with a convenience sample of non-college educated young adults to review the content and wording of questions, and to identify additional questions that should be asked. After testing the question path with the convenience sample, two questions were revised to make the question more understandable. The question path was then finalized. All study materials and protocols were approved by the University of Oklahoma Institutional Review Board (IRB) prior to data collection. See Appendix D for Study 1 question path.

### *Sampling Procedures*

This study used both purposive and saturation sampling. There are a number of purposeful sampling strategies that can be used in qualitative inquiry. This study utilized what is called typical case purposeful sampling.<sup>24,90</sup> In typical case sampling the purpose is to describe and illustrate the range of responses of what is typical within a particular phenomenon.<sup>24,90</sup> The focus of this type of sampling is not to make generalized statements about the experiences of all people but rather to provide in-depth examples of the experiences of the sampled typical cases.<sup>90</sup> For this study not being college educated and possessing a commercially available health and fitness app or wearable activity tracker were the primary characteristics used to define a typical case. Utilizing this type of sampling allowed for this study to capture detailed information about young adults who adopt and use commercially available health and fitness applications and wearable activity trackers on their own. The purpose of using this type of sample is so that themes from the interviews can be reported to: 1) understand how young adults are using technology to help them change health behaviors, and 2) allow for young adult perspectives to be considered by health promoters who want to incorporate health and fitness applications into behavior-change interventions. These perspectives can aid in tailoring interventions to the preferences and needs of this segment of young adults, ultimately making the intervention more effective.

A saturation sampling strategy was also employed. Saturation sampling is a qualitative sampling strategy where participants are continually recruited until there is no new information about the theoretical constructs being learned from participants.<sup>24,25</sup> This strategy was chosen to allow for sampling to the point of redundancy, and to

provide as much data as possible to be collected on this emerging behavior. The IRB approval allowed for up to 50 interviews to be conducted, but the actual number of interviews was lower than 50 because saturation was reached at interview 26, and then an additional 5 interviews were conducted to ensure saturation.

### ***Data Collection***

Because non-college educated young adults are often in the workforce, diverse recruitment techniques are vital to attracting participants. Therefore a number of recruitment methods were used for this study. First, participants were recruited locally through posters in local businesses identified by a convenience sample of young adults as businesses that cater to young adults (e.g. coffee shops, restaurants, bars, entertainment venues). Local participants and participants from across the continental United States were also recruited through postings via online message boards, primarily Craigslist. Participants were screened over the phone, by email, or by text based on the inclusion criteria prior to scheduling a time and date for the interview. Only the Craigslist-provided email was used as a contact for postings on Craigslist. Inclusion criteria for the interviews were that participants must: 1) be between the ages of 18-29, 2) live in the United States, 3) currently be using at least one health and fitness app or wearable activity tracker, and 4) not be enrolled in college, have graduated from college, or attended college for longer than 1 semester. See Appendices E and F for Study 1 recruitment poster and online recruitment posting.

If a participant met the inclusion criteria, an interview was scheduled at his/her convenience. Participants were interviewed in person if they were within driving distance or online if not. In person interviews were conducted in reasonably private

locations (e.g. coffee shops, bookstores, restaurants, libraries) that provide for participant convenience and confidentiality of the conversation. The online interviews were conducted on the free online video chatting site Google Hangout. Interviews conducted online were conducted in private.

Prior to the interview the participant was given a written informed consent that outlined the study purpose and gained consent for participation in the study and for the audio recording of the interviews. Once informed consent was received the participant completed a short demographic questionnaire prior to beginning the interview. In person questionnaires were given in hard copy, while online questionnaires were given verbally by the interviewer. Before beginning the interview questions, the interviewer provided a verbal description of the interview process and gained verbal assent for the audio recording. All interviews were recorded using two devices to ensure that the interview was captured. In person interviews were recorded on small handheld Sony recorders with microphones that allowed for additional sensitivity to sound. Online interviews were recorded using computer program called Voice Recorder. At the conclusion of the interview participants received a \$20 store gift card to thank them for their time. Once the interview was completed the recordings were uploaded to a secure device, and once the recording was confirmed, the audio files were erased from the portable devices. Every effort was made to protect the confidentiality of participants when conducting in person and online interviews. See Appendix G for Study 1 demographic questionnaire.

### ***Data Analysis***

Once all the interviews were completed, the recordings were transcribed verbatim to allow for a complete record of the interaction. All transcriptions were checked for accuracy by listening to the original recording and correcting any errors or omissions. Once the transcripts were corrected they were loaded into the NVivo version 11.0 qualitative research software for analysis. NVivo is a qualitative research software specifically designed to facilitate coding and theme identification. A team of three researchers was used during the analysis of the transcripts. Both the student researcher and the faculty advisor have been trained by a certified NVivo trainer, and the other student was trained by the faculty mentor. One team member is a senior researcher who has extensive experience with qualitative analysis. Utilizing a three person team allowed for different perspectives to be captured during data analysis and aided in analyst triangulation.<sup>24,25</sup> Analyst triangulation is a qualitative process where multiple analysts are used to analyze data. This helps to reduce the potential bias that may come from one person conducting all data collection and analysis.<sup>24</sup>

A code book was developed by: 1) reviewing previous literature on the topic, 2) listening to the interview recordings, and 3) reading through the transcripts multiple times. Once a preliminary codebook had been established then the research team reviewed the codes and coded four interviews together. The codebook was then modified to change code definitions, combine redundant codes, and add additional codes. The team then chose five interview transcripts to code independently and compare. This aided in establishing that all the researchers were applying codes consistent with the code definitions that the research team established.<sup>24,25</sup> After these



comparisons were done and sufficient consistency among the coders was established, all remaining coding was completed independently to ensure that the research team was not influencing one another and to ensure that diversity in coding was not limited. The reduction of bias and the diversity of coding are important to qualitative research as the purpose of having more than one coder is to ensure that all participant perspectives are being captured during coding. Having multiple coders with different experience levels, backgrounds, and/or areas of focus can best ensure that the codes are reflective of participant perspectives and not coder perspectives.<sup>24</sup> Upon completion of coding the team met to discuss any discrepancies or disagreements about coding and to come to consensus prior to moving to theme identification. The inter-coder agreement was calculated through NVivo for MG and MKC (only two coders can be calculated). The inter-coder agreement for this study was 97%.

Before beginning theme identification a threshold was established to lend to the credibility of the themes identified in the research. By establishing a threshold that requires that a certain number of participants mention a specific topic before it can be considered a theme the risk of reporting a topic as a theme when only one or two participants may have said it is reduced. This reduces the risk of reporting themes that are not representative of a typical case, which is ultimately the goal of the research. In several recent publications researchers have used a threshold value of 25% of participants mentioning a theme as an appropriate threshold to establish a theme.<sup>18,91,92</sup> Theme identification began with the research team working independently to identify themes and checking to see if they met the threshold. Then the team came together to discuss themes and subthemes and how each should be grouped for reporting. Once

themes were finalized, quotes that represented each theme were pulled from transcripts, checked for context, and provided to support the theme statements.<sup>24,25</sup> Finally the transcripts were reviewed again for disconfirming evidence of the established themes. Disconfirming evidence of a theme may result in the identification of contrasting themes that should be reported or may result in the need to qualify a theme by reporting that there were some cases that did not support the theme.<sup>25,88</sup> This technique provides a more balanced perspective and an indication of the diversity and range of responses within a theme. It also increases transparency and reliability within thematic analysis.<sup>25</sup> Upon completion of the study all voice recordings were deleted to ensure participant confidentiality.

## **Study 2 Methods**

### ***Research Design***

In order to develop effective interventions health promotion practitioners must first have an in-depth understanding of the knowledge, influences, and behaviors of the specific population they are trying to reach. In attempting to gain in-depth information qualitative inquiry allows for researchers to carefully plan and execute research that explores why certain groups adopt health behaviors and/or continue these behaviors once they have adopted them.<sup>24,25,88</sup> This provides researchers with the ability to reveal unexpected motivations or beliefs as it elicits unique and intimate knowledge about the research participants. The results can then be used to inform additional research and/or to design targeted effective intervention strategies for specific behaviors.

This study used the qualitative approach of individual interviews to explore commercially available wearable activity tracker use in college student young adults.

Interviews are an ideal data collection tool for this topic and segment of the population for several reasons. The first is that interviews provide the opportunity to establish a one-on-one connection between the participant and the interviewer, and can lead to more detailed description of personal health behaviors.<sup>24</sup> Secondly, conducting individual interviews rather than focus groups allows for young adults to feel comfortable discussing what can be sensitive subjects such as weight gain, obesity, and fitness habits. Finally conducting individual interviews allows for the questions to be tailored to the individual's wearable activity tracker, which provided a simple way to capture the participant's personal experiences with his/her particular device.

### ***Theoretical Foundations***

This study was developed through a systematic process and was guided by the Pragmatic Theory of Truth (Pragmatism), Social Cognitive Theory (SCT), and a review of the established literature in this area.<sup>24,89</sup> Pragmatism provided the qualitative theoretical foundation of this study. Pragmatism is focused on discovering the practical implications of a certain phenomenon, and in particular how findings can be applied to addressing concrete issues and problems.<sup>24</sup> Pragmatism is aimed at seeking practical and useful answers that can potentially solve or provide direction in how to address concrete health issues. The use of commercially available wearable activity trackers is an emerging behavior and researching this phenomenon can provide valuable insights into these devices and the people who use them. The use of pragmatism as the foundation of this study allowed for the research to gather timely and actionable information about this emerging behavior.<sup>24</sup> As health promotion is ultimately a field that is looking to change behavior the goal of this work was to add to the practical

information available to health promotion specialists who want to use wearable activity trackers for behavior change in research and/or practice. The commercial availability and popularity of these wearable activity trackers increases the urgency in which health promoters need to gain information about these products as adoption of these products by young adults is occurring rapidly and with little support from health promotion professionals. With a pragmatic approach to the research this study was able to provide timely and useful information about a growing trend in young adult health and fitness. This allows health promotion efforts to be acceptable and relevant to priority populations. Some examples of the questions that were answered by using a pragmatic approach are: 1) why are young adults adopting commercially available wearable activity trackers, and 2) how are commercially available wearable activity trackers being used by young adults to change behavior?

In addition to the pragmatic foundation of this study an established health promotion theory was also employed to develop several interview questions. Social Cognitive Theory (SCT) was created by Albert Bandura in 1986.<sup>4</sup> This theory has been shown to be a practical and successful theory for behavior changes related to physical activity and nutrition.<sup>89</sup> In addition Bandura has outlined how SCT can be utilized for health promotion purposes and even defines the constructs in SCT that best fit with health promotion activities.<sup>89</sup> It is these constructs and their definitions that were used to guide multiple questions in the interview question path. Because all the participants that were recruited for this study were already attempting to change or maintain their target behavior by using commercially available wearable activity trackers this theory is a logical and useful choice. By asking participants questions that were guided by SCT this

study was able to capture what features of the wearable activity trackers are related to established behavior change techniques, and which of these features may be aiding in assisting participants most with behavior change or maintenance. This provides health promotion specialists with a theoretical foundation that can be utilized to strengthen programming created for use with wearable activity trackers. See Appendix H for Study 2 questions guided by SCT.

### ***Question Path Development***

The development of the interview question path was a systematic process. The first step was to consider what questions should be asked based on the theoretical foundation of the study and a review of the literature. The next step was to ensure that the questions were aimed at answering one of the research questions. The final step was to determine the order in which the questions were asked. Typically broad questions or main questions are asked first, followed by more specific questions or follow-up questions. Finally probes that encourage participants to provide details may be used to elicit the most in-depth responses possible.<sup>25</sup> In addition to ordering the questions the format or the way a question is asked is also an important step in developing the interview question path. There are four primary types of questions: 1) experience/behavior, 2) knowledge, 3) opinion/value, and 4) feeling.<sup>25</sup> Experience/behavior questions focus on allowing the participant to describe past and present experiences, behaviors, actions, and activities.<sup>25</sup> Knowledge questions focus on discovering what participants see as factual information regarding the phenomenon being explored.<sup>25</sup> Both of these types of questions are often asked as main or follow up questions as they are often less likely to require significant contemplation or self-

examination on the part of the participant. Opinion/value questions focus on how participants interpret specific events and often ask participants to reflect on decision making processes.<sup>25</sup> These questions may assist the researcher in revealing goals, opinions, norms, intentions, desires, and values of the participants. Feelings questions focus on emotional responses to the phenomenon of interest.<sup>25</sup> Opinion/value and feelings questions are often asked as follow-ups or probes and may require multiple probes to allow the participant time to contemplate the question being asked. Employing a variety of question types allows for a more thorough exploration of the topic and may capture information that simply asking one type of question cannot accomplish. See Appendices I and J for Study 2 example questions

Once the process of developing the interview question path was completed the question path was tested with a convenience sample of two college students to review the content and wording of questions. After testing the question path with the convenience sample, two questions were revised for clarity prior to finalizing the question path. All study materials and protocols were approved by the University of Oklahoma Institutional Review Board prior to data collection. See Appendix K for Study 2 Question Path.

### ***Sampling Procedures***

This study used both purposive and saturation sampling. There are a number of purposeful sampling strategies that can be used in qualitative inquiry. This study utilized what is called typical case purposive sampling.<sup>24,90</sup> In typical case sampling the purpose is to describe and illustrate the range of responses of what is typical within a particular phenomenon.<sup>24,90</sup> The focus of this type of sampling is not to make

generalized statements about the experiences of all people but rather to provide in-depth examples of the experiences of the sampled typical cases.<sup>90</sup> For this study attending college and possessing a commercially available wearable activity tracker were the primary characteristics used to define a typical case. Utilizing this type of sampling allowed for the study to capture detailed information about young adults who adopt and use wearable activity trackers on their own. Themes from the interviews are then reported to: 1) understand how young adults are using wearable activity trackers to help them change health behaviors, and 2) allow for young adult perspectives to be considered by health promotions specialists who want to incorporate wearable activity trackers into behavior change interventions. These perspectives can aid in tailoring interventions to the preferences and needs of this segment of young adults.

A saturation sampling strategy was employed. Saturation sampling is a qualitative sampling strategy where participants are continually recruited until there is no new information about the theoretical constructs being learned from participants.<sup>24,25</sup> This strategy was chosen to allow for sampling to the point of redundancy, and to provide as much data as possible to be collected on this emerging behavior. The IRB approved the study to conduct up to 50 interviews. However, saturation was reached at approximately 30 interviews; therefore an additional 5 interviews were conducted to ensure saturation was reached.

### ***Data Collection***

A number of recruitment methods were used for this study. First, participants were recruited on and around college campuses through posters in local businesses identified by the convenience sample of college student young adults as businesses that

cater to college students (e.g. coffee shops, restaurants, bars, entertainment venues). Local participants and participants from across the continental US were also recruited through postings via online message boards, primarily Craigslist. Participants were screened over the phone, by email, or by text message based on the inclusion criteria prior to scheduling a time and date for the interview. Only the craigslist-provided email was used as a contact for postings on Craigslist. Inclusion criteria for the interviews were that participants must: 1) be between the ages of 18-25, 2) live in the United States, 3) currently be using at least one wearable activity tracker, and 4) be currently enrolled in college as an undergraduate. See Appendices L and M for study 2 recruitment poster and online recruitment posting.

If a participant met the inclusion criteria, an interview was scheduled at his/her convenience. Participants were interviewed in person or online. In person interviews were conducted in university offices or reasonably private locations (e.g. coffee shops, bookstores, restaurants, libraries) that provided for participant convenience and confidentiality of the conversation. The online interviews were conducted on the free online video chatting site Google Hangout. Interviews conducted online were conducted in private.

Prior to the interview the participant was given a written or online informed consent. Once informed consent was received then participants completed a short demographic questionnaire. In person questionnaires were given in hard copy, while online questionnaires were read aloud to the participant and the interviewer marked their answers on the hard copy. Before starting the interview questions the interviewer provided a verbal description of the interview process and gained verbal assent prior to



proceeding with the interview. All interviews were recorded using two devices to ensure that the interview was captured. In person interviews were recorded on small handheld Sony recorders with microphones that allowed for additional sensitivity to sound. Online interviews were recorded using a computer program called Voice Recorder. At the completion of the interview participants received a \$20 store gift card to thank them for their time. Once an interview was completed the recording was uploaded to a secure device, and once the recording was confirmed then the audio files were erased from the portable devices. See Appendix N for the Study 2 demographic questionnaire.

### ***Data Analysis***

Once all the interviews were completed, the recordings were transcribed verbatim to allow for a complete record of the interaction. All transcriptions were checked for accuracy by listening to the original recording and correcting any issues. Once the transcripts were corrected they were loaded into the NVivo version 11.0 qualitative research software for analysis. NVivo is a qualitative research software specifically designed to facilitate coding and theme identification. A team of three researchers was used during the analysis of the transcripts. Both the student researcher and the faculty advisor were previously trained by a certified NVivo trainer, and the additional student coder was trained by the faculty advisor. One team member was a senior researcher who has extensive experience with qualitative analysis. Utilizing a multi-person team this allowed for different perspectives to be captured during data analysis and aided in analyst triangulation.<sup>24,25</sup> Analyst triangulation is a qualitative process where multiple analysts are used to analyze the data. This helps to reduce the

potential bias that may come from one person conducting all data collection and analysis.<sup>24</sup>

A code book was developed by: 1) reviewing previous literature on the topic, 2) listening to the interview recordings, and 3) reading through the transcripts multiple times. Once a preliminary codebook was established then the research team reviewed the codes and coded four interviews together. The team then chose five additional interview transcripts to code independently and compare. This aided in establishing that all the researchers were applying codes consistent with the meanings that the research team had established.<sup>24,25</sup> After these comparisons were done and sufficient consistency among the coders was established then all remaining coding was completed independently to ensure that the research team was not biasing one another and to ensure that diversity in coding was not limited. The reduction of bias and diversity of coding are important to qualitative research as the purpose of having more than one coder is to ensure that participant perspectives are being captured during coding. Having multiple coders with different experience levels, backgrounds, and/or areas of focus can best ensure that the codes are reflective of participant perspectives and not coder perspectives.<sup>24</sup> Upon completion of coding the team met to discuss any discrepancies or disagreements about coding and came to consensus prior to moving to theme identification. The inter-coder agreement was calculated by NVivo for MG and MKC. The inter-coder agreement for this study was 98%.

Before beginning theme identification a threshold was established to lend to the credibility of the themes identified in the research. By establishing a threshold that requires that a certain number of participants must mention a specific topic before it can

be considered a theme the risk of reporting a topic as a theme when only one or two participants may have said it is reduced. This reduces the risk of reporting themes that are not representative of a typical case, which is ultimately the goal of the research. In several recent publications researchers have used a value of 25% of participants as an appropriate threshold to establish a theme.<sup>18,91,92</sup> Theme identification began with the research team working independently to identify themes and checking to see if they met the threshold. Then the team came together to discuss themes and subthemes and how each should be grouped for reporting. Once themes were finalized, quotes that represented each theme were pulled from transcripts, checked for context, and provided to support the theme statements.<sup>24,25</sup> Finally the transcripts were reviewed again for disconfirming evidence of the established themes. Disconfirming evidence of a theme may result in the identification of contrasting themes that should be reported or may result in the need to qualify a theme by reporting that there were some cases that did not support the theme.<sup>25,88</sup> This provides a more balanced perspective and an indication of the diversity and range of responses with a theme. It also increases transparency and reliability within thematic analysis. Upon completion of the study all voice and video recordings were deleted to ensure participant confidentiality.

## **Chapter 4: Results**

### **Manuscript 1: Conducting Online Qualitative Research with Young Adults: Lessons Learned and Recommendations for Researchers**

#### ***Abstract***

Online recruitment and data collection offer many advantages to qualitative researchers. For example, online recruitment has the ability to expand reach for little or no additional cost, allow flexible timing for participants, and offers an alternative environment for those who may not be comfortable interacting with researchers in traditional settings. However, to utilize these ever-evolving technologies we must first understand the benefits and challenges of conducting online research. The purpose of this methodological article was to describe the lessons we learned from recruiting for, and conducting online interviews with two segments of young adults. We also provide recommendations to other researchers for their own online recruitment and data collection with a special emphasis on hard-to-reach participants. We hope that by sharing our experiences we can help other researchers who want to use these methods.

## ***Introduction***

Health researchers have increasingly opted to use online techniques for recruitment and data collection.<sup>93-95</sup> There are a number of ways that researchers have taken advantage of online methods. For example, email and websites are effective means for communicating with research participants, and online communication channels such as social media, message boards, or online marketplaces have been utilized frequently and successfully for recruitment and data collection purposes.<sup>95-102</sup> In recent years qualitative researchers have increased their utilization of online options for activities such as recruitment, interviews, and focus groups.<sup>103-107</sup>

Online recruitment and data collection in qualitative research holds many benefits for researchers, especially those focused on hard-to-reach populations, such as those often absent from research samples due to issues of social exclusion, lack of trust in research, or lack of effort by researchers.<sup>104</sup> For example, many young adults are recruited in college settings, but young adults who transition straight-to-work from high school (e.g. those who did not attend a 2 or 4 year college, but rather went straight into the workforce excluding those who went into the military) are often overlooked. Unlike college students, this population is not easy to access because they do not reside in a single location. Recruiting hard-to-reach young adults can require significantly more effort, time, and resources often with limited results.<sup>106,108</sup> Online recruitment has the potential to be more convenient and accessible to participants, which can provide more opportunities for researchers to recruit geographically diverse and hard-to-reach samples.<sup>103-106,109,110</sup> Recruitment materials can be posted in multiple geographic areas and different online channels can be used to target specific populations with purposive

sampling. For example, Facebook ads could be used to recruit teens in the southwest region of the US, who contain certain attributes (e.g. currently in school, gender, etc.). Additionally this type of recruitment can often be done for little or no cost thus expanding the pool of potential participants that can be recruited, and saving valuable resources for other research activities.<sup>99,101,103,106,111</sup>

Online data collection is also gaining popularity among qualitative researchers and some research has shown online interactions to be equivalent to in-person interactions.<sup>104,112</sup> Qualitative researchers have used a number of online options to conduct data collection. Online qualitative data collection methods that do not occur in real time, such as discussion boards and email have been used for many years.<sup>103</sup> These methods provide flexibility in timing as participants can respond to questions at their convenience and inhibitions may be reduced since face-to-face communication is eliminated.<sup>105</sup> Recently, real time data collection techniques have gained momentum, such as chat room discussions and online video conference technologies.<sup>103,109,113</sup> While both chat rooms and video conference provide opportunities for researchers to be responsive to participants, the latter has the potential to provide an experience similar to traditional in-person qualitative data collection.<sup>103,109</sup> Additional benefits of online research can be seen in increased access to participants through flexible timing for data collection and increased participant availability. For example, one study found that participants that were reluctant to attend a face-to-face interview, or did not feel that they had time for a face-to-face interview, were more likely to participate in an online interview.<sup>109</sup> Online techniques also provide an alternative environment for participation

where hard-to-reach populations may be more comfortable interacting with researchers.<sup>104</sup>

Despite an increased level of interest in online methods this is still an emerging area for qualitative research. Those utilizing online options are often doing so through trial and error with little guidance as to what works and what barriers to anticipate. While researchers have begun providing guidance for conducting online research, continued documentation of our experiences and lessons learned can provide important insights.<sup>98,103-105,109</sup> This is especially important as technology is evolving rapidly, and can change significantly in a relatively short amount of time. Additionally, an important part of our research process should be sharing our experiences so that others in the field can learn from our successes and mistakes.

The purpose of this methodological article was to describe the lessons we learned from conducting online recruitment, screening, and interviewing of college students and young adults who went straight-to-work (STW) from high school. We aim to provide a special emphasis on the STW young adults who are not as easily accessed as college students, and consequentially are often omitted from research. A description of two recent studies in which we used online methods is provided for context. The studies described below used both traditional and online methods for recruitment and interviewing. However, we will only discuss the online methods.

### ***Description of Studies***

The following is a description of two studies conducted in 2016 and 2017. In one study we were interested in college student use, attitudes, and beliefs about wearable activity trackers (e.g. Fitbit, Jawbone, Apple Watch), and in the second study

we were interested in STW young adults and their use, attitudes, and beliefs about wearable activity trackers and health and fitness applications (e.g. MyFitnessPal, Runkeeper). We chose to conduct individual semi-structured interviews with participants because topics related to weight loss, fitness, and nutrition can be difficult to discuss in a group setting. Our two primary objectives were to explore: 1) young adult perceptions of the acceptability of these technologies, and 2) young adult perceptions of the impact these technologies have on their health behavior. A secondary objective was to explore how young adults feel about the utility, features, and convenience of these products in order to gain a better understanding of how these technologies could potentially be used by public health promotion researchers and practitioners. We chose to segment our young adult population into two groups (i.e. STW young adults and college student young adults), since STW young adults are often overlooked in health promotion research, and are more difficult to recruit than college student young adults.<sup>34</sup> We sampled this segment because we believed this group was especially important to health research, as lower levels of education are associated with a number of health issues and behaviors.<sup>62,63</sup>

### ***Recruitment of Participants***

For the first study, we recruited STW young adults from July 2016-July 2017, and for the second study we recruited college students from January 2017-July 2017. For recruitment, we primarily used the online marketplace Craigslist, and also posted on Reddit and Facebook Marketplace. We regionalized our postings (e.g. Northeast, Southwest) so that there were multiple cities throughout the US targeted for recruitment. We also posted in both large metropolitan cities and smaller cities in each



region in an effort to connect with as many young adults as possible. When recruiting college student young adults we posted in cities with one or more universities. Postings were checked every other week and updated as necessary. Potential online participants were asked to contact us by email only. Potential STW participants were screened using the following inclusion criteria: 1) must be between the ages of 18-29, 2) must live in the United States, 3) must be using at least one health and fitness app or wearable activity tracker, and 4) must not be enrolled in college, have graduated from college, or attended college for longer than one semester. Potential college student participants were screened using the following inclusion criteria: 1) must be between the ages of 18-25, 2) must live in the United States, 3) must be using at least one wearable activity tracker, and 4) must be enrolled as an undergraduate. Participants that met the inclusion criteria were scheduled for an online interview at their earliest convenience. It should be noted that most of the local participants also opted for an online rather than in-person interview when given an option.

### ***Data Collection***

Once an online interview was scheduled, we sent an email confirming the time and date. We attempted to schedule interviews the same day or within two days of contact with the potential participant. For interviews occurring in the morning we sent a reminder email the afternoon before, and for afternoon/evening interviews we sent a reminder email the morning of the scheduled interview. While participants were given multiple options for the interview, most were conducted in the evenings at the participants' preference. If we scheduled an interview more than two days in advance, we sent a reminder email a few days before the scheduled interview, and again the

evening/morning of the interview. The reminder emails included: 1) a greeting with the participant's name, 2) the time and date of the interview, and 3) a brief description of how the interview would be initiated including instructions of how to connect to the interviewer. Approximately 5-10 minutes before the scheduled interview we sent the participant an email with a link to join the video call.

The procedure we used for online data collection featured five steps: 1) video call initiation, 2) informed consent, 3) demographic questionnaire, 4) interview, and 5) incentive issuing. The first step was to initiate the video call with the participant. We primarily used Google Hangout video calls because they were free, easy to use, and approved by our academic institutional review board (IRB). With Google Hangout, video call users can create a link that can be emailed to participants. This means participants only had to click a link to join the call to the interviewer. This simple link process was less intimidating to our STW young adults who often reported being unfamiliar with this type of technology. In some instances, participants experienced difficulty connecting through the link. When this occurred we connected with them using their google account username, or they connected to us using our study specific google account username.

Once a call was initiated, we gave the participant a brief overview of the study, discussed technical issues, confirmed the participant's answers to the screening questions, and sent a link to an online informed consent form that was created using Qualtrics, an online survey system. The informed consent process featured two buttons. The first indicated that they provided consent and the second indicated that they did not provide consent. The participant was instructed to take their time, read through the

consent information, and to ask any questions that they had regarding the study or the consent process. Once a participant indicated that they had consented the interviewer would log into the Qualtrics system to confirm their response. If a participant did not consent they were thanked for their time and the video call was terminated.

The next step in the process was to complete a demographic questionnaire. We decided it would be best to read the questions to the participant, and record their responses rather than asking them to complete the questionnaire in Qualtrics. We used this method because in a previous study using Qualtrics, we had multiple participants indicate they had completed the questionnaire when they had not. Therefore, having participants complete the questionnaire verbally with the interviewer eliminated the risk of not receiving the answers to the questionnaire. It also provided an opportunity for the participant and interviewer to build rapport before the audio-recorded portion of the online interview. This was especially important for the STW young adults, as they were less likely to have participated in an interview or used online video calls before the study.

After the demographic questionnaire was completed a Voice Recorder audio recording device was started. We chose to use only audio recording for the interviews because we determined that having a video recording was unnecessary, and we wanted to ensure that the participants felt as comfortable as possible. Once the recorder was started the interviewer read a script that addressed the purpose of the research, the informed consent process, confidentiality, and the use of audio recording to capture the interview. We addressed confidentiality during the script and explained how we intended to protect their identity through specific examples. Participants were also

asked to verbally consent to the interview and to being audio recorded. At the conclusion of the verbal explanation of the process, the interview proceeded. Most interviews lasted between 30-45 minutes. Upon completion of the interview the audio recording was stopped, participants were asked if they had any questions about the study, and if so, the interviewer answered the questions.

To thank the participants for their participation in the study they were asked to provide a name and an email address so that an electronic gift card could be sent to them. Each participant was allowed to choose between a large online retailer (Amazon) or a large nationwide store with online options (Target). After completing the interview, and terminating the video call the interviewer then immediately sent the e-gift card, worth \$20.

**Table 1: Checklist for Conducting Online Interviews**

	<b>Action</b>	<b>Details</b>	<b>Timing</b>
<b>Before the Interview</b>	Send reminder email(s) depending on time between scheduling and actual interview this could be a single email or multiple emails.	Reminder emails should provide time, date, and description of how the interview is initiated including instructions of how to connect to the interview.	At the time the interview is scheduled.
	Test and prepare your equipment and paperwork.	Gather the research paperwork. Test all your equipment and the video call program.	30 minutes to 1 hour before scheduled interview.
	Send email with instructions of how to join the video call.	Emails for joining the video call should include detailed information about how to join the video call. Including basic troubleshooting notes can also be helpful for participants.	5-10 minutes before the scheduled time.

<b>During the Interview</b>	Make introductions and check that participant equipment and video call program is working.	Run through basics of the video call program and sound/video quality. Answer any questions the participant has regarding how to navigate the program or their computer.	At beginning of the interview.
	Confirmation of screening questions	Confirm their answers to the screening questions, but asking them the questions again while in the video call.	
	Send informed consent link to participant.	Explain the informed consent to the participant and give them as much time as they need to read and complete the informed consent.	Before starting any data collection.
	Confirm consent received	Log into the system and confirm consent was received.	
	Complete demographic questionnaire together.	Read the questions on the demographic questionnaire to the participant and complete the form	After informed consent is received, before the interview is started.
	Conduct interview	Using the question path conduct the interview. Make sure to inform the participant when you plan to start the audio recording	After starting the audio recording.
	Interview completion	Wrap up the interview by answering questions that the participant has regarding the study.  Collect appropriate information for issuing the incentive.	After stopping the audio recording.

<b>After Interview</b>	Issue incentive	Complete any appropriate paperwork and filing. Complete the process for issuing the incentive to the participant.	After terminating call with participant.
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### *Lessons Learned*

Provided below are some of the important lessons we learned, and recommendations we have for conducting online recruitment and data collection. This is divided into three sections: 1) general considerations, 2) recruitment/screening, and 3) interviewing.

#### *General Considerations*

**Ensure that your research is designed with the participant in mind.** A key part of the interview process is developing trust, rapport, and openness with your participant. Online interactions are interpersonal contacts where physical space is not shared. Non-verbal cues we use to interpret meanings may not be as apparent in online interactions.<sup>109</sup> While young adults have grown up with this technology, they still may not feel comfortable using technology for research purposes. Employing qualitative techniques, such as reflexivity and empathetic neutrality, are ways in which we assessed the quality of our interactions during the research process.<sup>24,25</sup> We then used our assessments in an iterative process to make the process better for our participants. For example, when conducting our research we wanted to ensure that we were fully engaged in each interaction, therefore throughout the process we utilized reflexivity, or our critical self-awareness.<sup>25</sup> To illustrate, in online interviewing there is often a small lag time between an interviewer asking a question, and the respondent hearing the

question and vice versa. This meant that many times participants would be talking, but the interviewer thought the participant was finished or the participant would start to answer a question while the interviewer was still asking it. This resulted in inadvertent interruptions throughout the interview. We found that to remedy this problem, we needed to add a longer pause between interviewer-participant exchanges, and transitions between questions. Note that this can seem awkward at first, but we believe it will help ensure that your participants are allowed time to complete their comments, and not feel rushed or as though they received a cue to stop talking. To avoid potential awkwardness while interviewing the participants, we told them prior to the interview that there might be some lag time and that we might pause longer than normal just to make sure that we captured all of their comments.

During each interview we worked hard to ensure participants felt comfortable, that they understood we were open to their experiences and perspectives, and we would listen without judgement.<sup>24</sup> This can be a difficult task in online interviews since the face is often the only part of the interviewer's body participants see during the interaction. Therefore, we found that facial expressions became very important, because typical cues of body language, such as a relaxed posture or leaning forward with interest, were not as apparent. For example, since we could not show interest through body language, we focused on smiling and nodding our heads as they spoke. Additionally, if participants were doubtful of us hearing something we would lean our face forward to be closer to the camera to cue to them that we could hear. After completing the demographic questionnaire with participants, we also refrained from taking notes during the interview to help establish a trusting connection. Like traditional

qualitative research, we recommend practicing your online interviews from start to finish several times before conducting the interviews. However, if it is possible try to practice with someone that is not familiar with qualitative research techniques, and someone who is not familiar with online video conferencing technology so that you can start to understand how you will connect with participants that are unfamiliar with research and with technology.

**Consider how you will *explain* your procedures for maintaining participant privacy and confidentiality.** Most privacy and confidentiality safeguards will be determined by the academic institutional review board (IRB). However, considering how to be transparent about privacy and confidentiality with online participants is important to address early during the study design process.<sup>114</sup> In some cases providing participants with an extra explanation of the specific ways in which you intend to hold their information in confidence will be important for ensuring trust and openness. We found this to be especially important with STW young adults, as they were less likely to have participated in research before and appeared to be more suspicious of researchers for historical reasons compared to college students. For example, even though we addressed our safeguards in the informed consent process, and provided a verbal explanation of the confidentiality of their responses, many STW young adults asked multiple questions about what would be done with their responses, how they would be used, and whether or not we would share their names and locations with people. We were prepared to answer every question they asked, and provided example scenarios to help those that had never seen a scholarly article understand how results are reported. We recommend preparing for these types of questions, and having concrete examples of



how the processes work for participants who may not be familiar with research, and may be concerned talking with a ‘stranger’ on a computer.

**Table 2: Checklist for Online Recruitment and Interviews**

<b>Step 1: Choose online technology for recruitment and data collection</b>
<input type="checkbox"/> Choose online recruitment sites
<input type="checkbox"/> Choose web conferencing technology
<input type="checkbox"/> Choose online recording methods
<input type="checkbox"/> Get IRB approval for chosen options
<b>Step 2: Set up your online recruitment</b>
<input type="checkbox"/> Set up your account(s) for recruitment
<input type="checkbox"/> Create posts and review before posting to the public
<input type="checkbox"/> Create a schedule for reviewing and reposting
<b>Step 3: Practice online interviewing</b>
<input type="checkbox"/> Set up your web conferencing technology
<input type="checkbox"/> Practice your online interview multiple times
<input type="checkbox"/> Practice troubleshooting technology issues

### *Recruitment/Screening*

**When posting on Craigslist, Reddit, Facebook, or other sites that allow for user posted content, you should regularly monitor and update your postings.** We used multiple sites for posting, but found Craigslist was the most effective recruitment method. Craigslist is an online marketplace where people can advertise and sell their goods and services. It has also become a popular place for researchers to recruit participants for studies. Other researchers have also suggested that Craigslist is a cost effective and reliable way to recruit participants.<sup>101,115</sup> We found that when we maintained a consistent posting schedule and posted in the appropriate locations that we received a large number of emails expressing interest in the study. However, we found that on several occasions our posts were never posted or were removed by Craigslist. This issue is known as ‘Craigslist ghosting’, which is when a post disappears from the site after receiving confirmation that the post was successfully listed.<sup>101</sup> This often

occurs for two reasons: 1) you have posted in an inappropriate category (read the acceptable postings language for each category before posting), or 2) you have posted too many times with the same title and language (this will flag your posting as spam and it will be removed). We recommend being mindful of your posting habits (e.g. always using the same title for your posting), and following the site rules for posting (e.g. do not post in categories that explicitly prohibit recruitment of participants) as ways to ensure that your posts are seen by potential participants.

On all the recruitment sites we used after a few days the responses to our posts decreased and then eventually ceased. We determined this was likely occurring because as new posts are added, they are placed at the top of the page, and old posts systematically move down, eventually disappearing off the first page of posts. We determined through trial and error that after approximately five days, responses to the posts began to slow, and after 10 days responses ceased. In response to this we began reposting every 10 days during the recruitment period and as a result of this strategy had consistent responses to our posts. Therefore we recommend regularly updating your postings to ensure that your post remains on the first page of the feed.

**Respond to inquiries as quickly as possible with a friendly email that includes the screening questions.** It is important to continue good recruitment practices with online techniques, because participants can lose interest in your study quickly if you are not attentive to their needs. We made every effort to respond to potential participants immediately when possible or within the same day. We responded with a friendly personalized email that included: 1) a greeting with their name, 2) a thank you for their interest, 3) the screening questions, and 4) the researcher's name and

contact information. If the participant answered some of the screening questions through their inquiry email then we acknowledged that in the response. When we responded within the same day, we had a better chance of scheduling qualified participants for an interview, compared to waiting 1-2 days to respond (e.g. this occurred when we received a high volume of emails). When we were unable to immediately respond we typically did not receive a response back from potential participants. We recommend researchers do not post through online systems unless they are prepared to answer and screen potential participants immediately. For example, avoid posting on a Friday unless you plan to respond to posts over the weekend. Developing a structured system in which you respond to emails as soon as they are received with a tailored email rather than a stock response will also assist in recruiting participants. Similar to other researchers we found that having multiple contacts with the participant prior to the interview also helped to build rapport between the participant and the researcher, thus adding another utility to the screening emails.<sup>103,109</sup>

**Develop a thorough screening protocol and use it to verbally verify eligibility at the beginning of the interview.** Approximately 60% of the young adults that responded to our postings did not qualify for the study. For example even though we clearly stated the age and educational status requirements, young adults that were outside this range, or had graduated from college, still responded. We developed a set of short questions that could be emailed immediately to the participant for screening. If they qualified for the study based on their answers we used their responses to the screening questions as a check during a verbal screening before starting the interview. There were multiple instances when a potential participant indicated one answer on the

emailed screening questions, but then responded differently when asked on the video call. In these cases we inquired about that discrepancy and worked to determine their eligibility based on their responses. Therefore, we recommend that an email screening and a secondary verbal screening be used with all participants to ensure that the participant actually meets the inclusion criteria for the study.

**During screening ask about their internet connection and location.** In the beginning of the study we asked the inclusion questions for the study in the screening email (e.g. age, college enrollment status, type of app/activity tracker), but as we progressed we found there were additional screening questions that should have been added. The first question we added was to determine if they had access to a private internet connection. We had several STW young adults attempt the video call from public locations with free Wi-Fi such as coffee shops, malls, and restaurants. This proved to be problematic because the connections were either not good or reliable. We adjusted our requirements after this occurred a few times, and explicitly required participants to use a private Wi-Fi connection to participate.

While we wanted to keep the screening questions to a minimum, we also added a question about their location. We started out using the postings the participants responded to as our guide to which time zone they were in for scheduling purposes. However, we had several instances where young adults resided in one city or state, but responded to postings from a different location. In addition, we had several instances where users had shared our postings to others on Craigslist, Reddit, or social media. This resulted in several interviews being scheduled in the wrong time zone. Therefore, we added a question about the participants' time zone to the screener. We later

discovered that some young adults were not aware of their time zone; therefore we chose to alter the question and asked them for their city and state so we could determine the time zone for scheduling.

**Have a system to monitor for repeaters and revisers.** Data collection occurred for approximately one year, and we had several instances where young adults tried to participate in the study twice. To combat this issue we kept a confidential log (e.g. name, email address, and location) of each young adult that contacted us and/or participated in the study, and cross checked potential participants against the log prior to scheduling. We collected ages and locations as part of the screening for inclusion. In addition we used names and emails to cross reference all potential participants. Monitoring for this issue is especially important if more than one researcher is screening and interviewing participants as some young adults continued to attempt to join the study by responding to postings from different locations or using alternative email addresses. We also had several instances where young adults who were screened out of the study for not meeting the inclusion criteria attempted to get into the study by contacting us again and revising their answers to the screening questions. We used the confidential detailed log to cross check for these revisers, and alerted them to the fact that they had already participated or were screened out of the study. In addition when we informed potential participants that they did not qualify for the study we did not tell them which question they answered that indicated to us they did not qualify. When doing this it is important to go through the entire screening before informing them of their status. If you notice that this is a problem you can include a few questions with no relevance to the inclusion criteria into the screening questions to help make it more

difficult for potential revisers to determine what caused them not to qualify during the first round of screening.

### *Interviewing*

**Send reminders for scheduled interviews.** We used email as our primary method of communicating with participants. We found that scheduling interviews the same day, or at most one to two days after the participant was screened, and sending at least one reminder (depending on the number of days away the interview was scheduled) helped ensure that participants showed up for their online interview. In several instances young adults that received the reminder email would ask to reschedule. These young adults typically followed through with the interview after rescheduling. Despite our best efforts, scheduled participants did not follow through with the interview approximately 15% of the time. When this happened we made only one attempt to reschedule with the participant.

**Schedule extra time for interviews to allow for late arrivals and technical issues.** We found that our data collection process lasted between 45-60 minutes including all of the major steps of the study. Despite this, we allowed 75-90 minutes to account for technical difficulties such as connection issues/sound quality, elimination of personal distractions for the young adults (e.g. TV, friends, other media), and to answer questions before and after the interview. On average participants joined the video call between 5-10 minutes after the scheduled time, and then needed time to get settled before they were ready to begin. We found that allowing time between the scheduled interviews was important, as when we did not do this, we ended up rushing to complete the interview. We also found that sometimes young adults needed help getting

connected and this allowed for troubleshooting to occur without putting pressure on the participant or interviewer.

**Prepare for technology issues.** The technical issue that we experienced most was related to the sound quality. In these cases the sound quality of the interview was distorted, weak, or faded in and out (or was choppy). This was usually found to be an issue with the participant's microphone and/or speaker or a weak internet connection. One way to potentially address the microphone and speaker issue is to ask participants to have a pair of headphones with a speaker available to troubleshoot this type of situation. We also recommend that the interviewer be prepared to assist the participant in troubleshooting issues. We found that many of our participants needed guidance to determine if their equipment was functioning properly. At minimum we suggest that all interviewers be comfortable with troubleshooting the video conference program and general computer features such as internal/external microphones, where the mute functions are located, and internet connection. It is also important to encourage participants to practice with the video conference technology before the interview. For example, in several instances the participant had never used the program and ended up downloading an app or completing an update on their computer. This takes up valuable interview time and creates frustration for the participant that can ultimately lead to them quitting the study.

**Choose incentives carefully.** We used e-gift cards as an incentive for participation in our studies. We found that the stores we used for incentives in previous studies (e.g. large chains retailers such as Wal-Mart and Target) were not popular with our online participants. Online participants typically requested PayPal or Amazon for

incentives, and wanted to ensure prior to participating in the interview that they would receive the incentive online. Many participants specifically inquired as to what type of incentive they would receive and made it clear that they did not want to be mailed their incentive, or to fill out paperwork to receive it. Others indicated that they would not give personal information such as their social security number, address, or phone number out in order to receive an incentive (note: this may be required by the accounting department of the university or funding organization so planning for how to discuss this with participants as well as how this information will be stored is important to work out in advance). We recommend choosing incentives that can be issued immediately following the interview (as would typically happen in a face-to-face scenario). We also recommend that a way to contact the researcher is provided to the participant as reassurance that they can follow up if there are issues with the incentive. We used Target and Amazon e-gift cards for this study, which allow you to track the e-gift card (note: very few participants wanted a Target e-gift card, but we continued to offer them as an option). This means that we received an email notification when it was sent and also when the e-gift card was opened. We made sure to mention this to the participants as a way of reassuring them that we were going to follow through, and also to reduce the chance that any of them would try to request an additional gift card by claiming they had not received the initial card sent. We also found that participants responded positively to having a choice regarding the retailer for the e-gift card. We would suggest considering your options carefully based on your participants and providing at least two options for incentives.



## *Conclusions*

Online qualitative research shows promise for health researchers that want to expand their geographic reach. In addition researchers interested in young adults and hard-to-reach populations may find online qualitative techniques particularly useful. However, there are still many lessons to be learned from researchers that are exploring these options. The more we can share with each other the better prepared to use these methods we will all be and the better we will be able to serve the participants. We have provided a series of lessons learned and practical recommendations for researchers interested in online qualitative research in hopes of furthering online qualitative research methods.

## Manuscript 2: Wearable Activity Trackers & Social Identity in Young Adults

### *Abstract*

**Background:** Wearable activity trackers are a ten billion dollar industry in the US with young adults making up most of the consumer market. While young adults may appreciate the practical utility of these devices, they may also see these devices as impression management tools with important value related to their social identity.

**Methods:** Qualitative methods were used to explore the beliefs of young adult adopters of wearable activity trackers. Young adults (n=57) ages 18-29 who were already using a wearable activity tracker were recruited to participate in individual interviews that explored the social value of these devices. Interviews were recorded, transcribed, and analyzed using NVivo. **Results:** Wearable activity trackers were seen as valuable tools for impression management and allowed young adults to present more than one actual or aspirational social identity. Young adults reported that wearing an activity tracker signaled to the world that they were health conscious, active, and fit regardless of their activity or fitness level. Non-college educated young adults reported that they felt wearable trackers portrayed them as modern and successful, while college students felt they appeared to others as techy and friendly. **Conclusions:** The identities that young adults associate with wearable activity trackers are important as identity can influence health behavior. Future research should consider these identity related issues as they may play a key role in adoption and use of these health tools.

## ***Introduction***

The growth of the internet and other technology has generated new opportunities for health promotion researchers and practitioners to connect with priority populations. In 2013 in the US, 81% of adults used the internet, and 59% report looking for health information online.<sup>116</sup> In a 2016 survey, 42% of US adults reported that technology was the biggest improver of life over the past 50 years, while only 14% reported that medicine and health to be improved life.<sup>117</sup>

In the US, technology and health tracking go hand in hand. Approximately 60% of US adults report that they track their weight, diet, or exercise. One in five of these adults (21%) said that they use some type of technology such as a smartphone application (app), a device (e.g. wearable activity tracker, smartwatch), a spreadsheet, or a website to assist their tracking.<sup>118</sup> Young adults are considered to be “digital natives” as they have been using technology their entire lives, and often turn to technology for information and assistance.<sup>10-12</sup> Young adults prefer smartphones over home computers and other devices with 86% reporting that they own a smartphone.<sup>119</sup> They also spend approximately 3.2 hours per day on their smartphone and are significantly more likely than older adults to use technology to help them track their health.<sup>116,120</sup> Smartphone-compatible technologies such as health and fitness applications and wearable activity trackers are popular among young adults, and may be especially important as access to health information on smartphones helps to bridge the gap to hard-to-reach populations such as those that may not have access to traditional home internet service.<sup>75</sup> Over 12% of US internet users are smartphone-only, meaning that they do not have home internet service, and one in five whose annual income is below \$30,000 a year rely on a

smartphone for internet access.<sup>121</sup> Additionally, 46% of smartphone owners report that their smartphone is something that they “can’t live without.”<sup>121</sup>

While health and fitness apps have been popular for several years, wearable activity trackers are becoming increasingly popular, as they provide an additional level of support beyond apps. Wearable activity trackers (also described as activity monitors, fitness trackers, fitness monitors, wearables, and smartwatches) are devices that are worn on the body (typically the wrist) that have an app that links with the device to report activities such as steps, sleep, heart rate, and calories burned. They are often defined using the following criteria: 1) the device is designed to be worn on the user’s body, 2) the device uses an accelerometer, altimeter, or other sensors to track the user’s movements and/or biometric data, and 3) the device uploads activity data to an online application that shows trends over time.<sup>40</sup> These wearable devices were a \$10 billion industry in 2016 with projected growth as high as \$17 billion by 2020.<sup>122</sup>

Technology is a central part of life for most US adults, and young adults in particular have grown up experiencing life with technology at the center. This priority placed upon technology means that its value rests in not only practical utility, but also its social value. The concept that a product is valued beyond its practical function is called conspicuous consumption.<sup>123-126</sup> Young adults may conspicuously consume technology to project a social identity. Social identity is often carefully cultivated so that an individual is viewed as a member of a specific “in-group” and thus can access the perceived benefits of the group.<sup>127-129</sup> This is especially relevant during young adulthood as young adults are exploring different identities and developing health habits that can last into adulthood.<sup>7,8,130</sup> For example, an “exerciser” identity is positively

associated with exercising in young adults.<sup>131</sup> When young adults adopt an identity that is associated with exercising or health this may increase the likelihood that they engage in these behaviors. Identities developed around particular health behaviors influence attitudes toward the behavior and how often individuals engage in those behaviors.<sup>131,132</sup> Since this time in the lifespan is a critical period in which health habits are explored and developed, adoption of health related identities can have a lasting impact on long-term health.<sup>7,8</sup>

Despite the growing popularity of wearable activity trackers, little research has focused on how independent adopters of this technology view and use these devices.<sup>18</sup> In particular, research on the complex relationship that young adults have with these devices and how they are incorporated into self-presentation or impression management regarding social identity is not present in the literature. Self-presentation also referred to as impression management is how people manage how they are perceived or evaluated by others.<sup>132-134</sup> This is an area of value for exploration as young adults likely see these devices as much more than health management tools. The purpose of this qualitative study was to explore perceptions of wearable activity trackers among young adult adopters with an emphasis on the social value of the devices.

## ***Methods***

This study used the qualitative approach of individual interviews to explore wearable activity tracker use in young adults. The interview question path was developed following a literature review of health related technology use.<sup>24</sup> The question path was tested with a convenience sample of young adults to review the wording of questions and identify additional questions that should be asked. Two questions were

revised based on comments from the convenience sample. All study materials and protocols were approved by the University of Oklahoma Institutional Review Board (IRB) prior to data collection.

This study utilized typical case purposive sampling.<sup>24,90</sup> The purpose of this sampling structure is to describe a range of responses that is typical within the behavior of interest.<sup>24,90</sup> This sampling does not aim to produce generalized statements about young adults but rather in-depth examples.<sup>90</sup> For this study we segmented the young adult population into two subgroups: 1) straight-to-work young adults (those who went straight to work from high school), and 2) young adult college students. Young adults are typically segmented by education (i.e. college students, non-college educated) rather than other key demographics such as occupation and income, as young adulthood is a transitional time period where finances and occupations may change multiple times in a short period.<sup>8,9</sup> Of these two groups, college students are often researched more due to the ease of recruiting within an institution. However, both segments should be considered as they may experience young adulthood differently resulting in different knowledge, influences, and beliefs which may impact health promotion programming designed for this time in the lifespan. Therefore, for the straight-to-work (STW) young adults, not attending college and possessing a wearable activity tracker were the characteristics used to determine a typical case. For the college student young adults, being enrolled as an undergraduate and possessing a wearable activity tracker were the characteristics used to determine a typical case. A saturation sampling strategy was also employed. Saturation sampling is a qualitative sampling strategy where participants are continually recruited until there is no new information about the theoretical constructs

being learned from participants.<sup>24,25</sup> This strategy was chosen to allow for sampling to the point of redundancy and to provide as much data as possible to be collected on this emerging behavior.

Two recruitment strategies were used. First, participants were recruited locally through posters in businesses identified by the convenience sample (e.g. coffee shops, restaurants, bars, entertainment venues). Second, young adults from across the continental United States were recruited via online message boards (e.g. Craigslist, Reddit). Participants were screened using the following inclusion criteria: 1) must be between the ages of 18 to 29 (STW) OR 18 to 25 (COL), 2) must live in the US, 3) must currently be using at least one wearable activity tracker, and 4) must not be currently enrolled in college, graduated from college, or attended college for longer than one semester (STW) OR must be currently enrolled in college as an undergraduate (COL). Participants meeting the inclusion criteria were interviewed in person or online. In-person interviews were conducted in a number of locations (e.g. coffee shops, bookstores, restaurants, libraries) that provided for participant convenience and confidentiality of the conversation. The online interviews were conducted using Google Hangout.

Prior to the interview, each participant was given a copy of the informed consent to read and sign. Online participants were given a link to the informed consent where they could electronically agree to the study. Because many young adults have never participated in research the interviewer also provided a verbal description of the interview process and gained verbal assent before proceeding with data collection. Participants were given a brief demographic questionnaire prior the interview. In-person

participants were given a hard copy to complete. For online participants, the interviewer read the questions to the participant and marked them on the hard copy. All interviews were recorded using two devices to ensure that the interview was captured. Once the interview was completed, the recordings were uploaded to a secure computer, and once the recording was confirmed, the portable devices were erased.

Once the interviews were completed, the recordings were transcribed verbatim, checked for accuracy, and loaded into the NVivo version 11.0 qualitative research software for analysis. A team of three researchers analyzed the data. Utilizing a three person team allowed for analyst triangulation.<sup>24,25</sup> Analyst triangulation is a qualitative process where multiple analysts are used to analyze data. This helps to reduce the potential bias that may come from one person conducting all of the data collection and analysis.<sup>24</sup> A codebook was developed by reviewing previous literature on the topic, listening to the interview recordings, and reading through the transcripts multiple times. Once a preliminary codebook was established, the research team reviewed the codes and coded eight (four STW and four COL) interviews together. The codebook was then modified to change code definitions, combine redundant codes, and add additional codes. The team then chose 10 interview transcripts (five STW and five COL) to code independently and compare. This aided in establishing that all the coders were applying codes consistent with the established definitions.<sup>24,25</sup> After these comparisons, all remaining coding was completed independently. Inter-coder agreement was calculated by NVivo for MG and MKC. The inter-coder agreement for the STW study was 97%, and for the COL study 98%. This was measured using only the transcripts coded individually. Upon completion of coding, the team met to discuss any discrepancies or



disagreements about coding and to come to consensus prior to moving to theme identification.

Theme identification began with the research team working independently to identify themes and checking to see if they met the a priori threshold. An a priori threshold of 25% of participants was established to lend to the credibility of the themes identified in the research. By establishing a threshold that requires a certain number of participants to mention a specific topic before it can be considered a theme, the risk of reporting a topic as a theme when only one or two participants may have said it is lessened.<sup>18,91,92</sup> This reduces the risk of reporting themes that are not representative of a typical case, which is ultimately the goal of the research. After theme identification was complete, the team came together to discuss themes and subthemes. Once themes were finalized, quotes that represented each theme were pulled from transcripts, checked for context, and provided to support the theme statements.<sup>24,25</sup> Finally, the transcripts were reviewed for disconfirming evidence of the established themes. Disconfirming evidence of a theme may result in the identification of contrasting themes that should be reported or may result in the need to qualify a theme by reporting that there were some cases that did not support the theme.<sup>25,88</sup> No contrasting themes were identified.

## ***Results***

The entire sample was made up of 57 young adults. Thirty-five (61%) of the young adults were college students, and 22 (39%) were classified as straight-to-work. Sixty-five percent of the participants identified as female, and 40% identified as a non-white ethnic minority. Thirty-five (61%) were from the Northeast (NE) region of the

US, four (7%) were from the Northwest (NW), four (7%) were from the Southeast (SE), and 14 (25%) were from the Southwest (SW).

Seventy-three percent of the STW young adults (n=22) were female, and 50% of them were self-identified as a minority. The mean age of the STW participants was 26 and 55% of them had a high school diploma. Fifty-nine percent of the STW young adult participants were employed full-time and 45% reported having just enough money to get by each month. Thirteen (59%) were from the NE, 3 (14%) were from the NW, 1(4%) was from the SE, and 5 (23%) were from the SW.

Sixty percent of the college student young adults (n=35) were female, and a 35% identified as a minority. The mean age of the college student participants was 21, and the majority of them were upperclassmen. Fifty-one percent reported working part-time or seasonally, and 51% reported having money left over at the end of each month. Twenty-two (63%) were from the NE, 1(3%) was from the NW, three (8%) were from the SE, and nine (26%) were from the SW.

**Table 3: Participant Demographics (n=57)**

	<b>College Student (n=35)</b>	<b>Straight to Work (n=22)</b>
<b>Question</b>	<b>Number (%)</b>	<b>Number (%)</b>
<b>Gender Identification</b>		
Male	14 (40%)	6 (32%)
Female	21 (60%)	16 (73%)
<b>Age (Mean = 21)</b>		
18-19	4 (11%)	2 (9%)
20-22	22 (63%)	6 (27%)
23-25	9 (26%)	14 (64%)
<b>Ethnicity</b>		
White/Caucasian	23 (65%)	11 (50%)
Black/African American	3 (9%)	4 (18%)
Latino(a) / Hispanic	3 (9%)	4 (18%)
Asian	6 (17%)	3 (14%)
<b>Year in School</b>		
High School		12 (55%)
Technical School		10 (45%)
1 <sup>st</sup> Year College	2 (6%)	
2 <sup>nd</sup> Year College	7 (20%)	
3 <sup>rd</sup> Year College	11 (31%)	
4 <sup>th</sup> Year College	11 (31%)	
5 <sup>th</sup> Year College	4 (11%)	
<b>Employment Status</b>		
Full-Time	2 (6%)	13 (59%)
Part-Time/Temporary	18 (51%)	6 (28%)
Don't Work Right Now	15 (43%)	3 (13%)
<b>At The End of the Month</b>		
Money Left Over	18 (51%)	8 (36%)
Just Enough Money	17 (49%)	10 (45%)
Still Have Bills to Pay	0 (0%)	4 (18%)
<b>Location of Participant</b>		
Northeast	22 (63%)	13 (59%)
Northwest	1 (3%)	3 (14%)
Southeast	3 (8%)	1 (4%)
Southwest	9 (26%)	5 (23%)

Young adults were asked what they thought about people who use wearable activity trackers and what others thought about their use of a wearable activity tracker. They discussed a number of ways that owning a wearable activity tracker impacted their

self-presentation and ultimately their ability to manage the impressions they made upon others. STW and college student young adults reported similar ideas about the value of wearable activity trackers in relation to health. However, their comments differed when it came to the social value of the devices. The themes are divided into two primary categories: 1) health value, 2) social value.

### *Health Value*

Most young adults discussed how wearing their activity tracker made them feel like a healthy or fit person, which ultimately boosted their self-esteem and confidence. Many discussed how they felt as though they were doing something good for themselves and that in wearing the activity tracker they had unlocked their potential to be an active person. Some reported that this was their first attempt at being responsible for their own health behavior and that they were proud that they were taking action.

*Before I had this I never knew how many steps I was taking in a day...so now that I do I just feel like I am tracking my body more and I am understanding my body better. – STW9*

*I'm trying to be more health conscious and I'm trying to be more on target and on track and do the things that I'm supposed to do so when I wear it I feel more knowledgeable. - COL19*

Some acknowledged that when they wear their activity tracker they *feel* healthier or fitter without making any real changes in their activity level. This group reported that they felt more motivated, accountable, and aware when they wore their activity tracker and hoped that this feeling would eventually translate to actual increases in activity.

*I feel like I'm living healthier even though that's not really the case because I love [fast food restaurant] food...but when I am wearing my Fitbit it makes me feel like I'm trying to live healthier. I may not be succeeding properly, but it makes me feel like I am on top of myself. – STW18*

*I feel fitter than I actually am. I am not into the fitness lifestyle right now because of school, but it has helped me increase my steps which I know is good.*  
– COL6

Young adults felt they conveyed two distinct images related to health by wearing their activity tracker. The first is that they are a health conscious person, and the second is that they are an active person. Many reported that wearing an activity tracker was indicative of both of these characteristics.

**Health Conscious Person.** The majority of young adults said that when their peers see them wearing an activity tracker that they think they are a health conscious person. They described being health conscious as a positive characteristic indicating someone who took a special interest in their overall health, which was something they felt was highly valued by their peers. Some talked about how being health conscious translated to more than just physical health. These young adults discussed how health conscious people are more focused, less stressed, and more emotionally stable.

*I think they would assume that I am health conscious...probably the main thing is she cares about her health and her life.* – COL9

*I care about my wellbeing, and my physical and mental health.* - STW21

Some of the young adults reported that even if they did not feel as though they currently fit the image of a health conscious person that the wearable activity tracker indicated an effort on their part to be healthy. These young adults were often those who were trying to lose weight or develop a healthier lifestyle rather than the young adults who already felt that they embodied a healthy or fit lifestyle. These statements were often accompanied by comments that people would think positively about them because they were being proactive and aspiring to be a healthy person.

*They probably think she is working out or she is trying to get healthy. She wants to be fit or something of that nature. – STW20*

*They're wearing them for a reason you know to track their steps or their heart rate or something like that. No matter what size, shape, or form they are obviously trying to better themselves in some form or fashion. – COL5*

**Active Person.** Many of the young adults discussed how having a wearable activity tracker shows that they are a fit or active person. This was discussed as a different characteristic than being health conscious, which was associated more with overall well-being than physical health. When describing why a person was seen as fit or active they often discussed lifestyle behaviors that the activity tracker monitors such as getting in 10,000 steps a day or taking the stairs. Similar to comments about being health conscious, some young adults acknowledged that they may not necessarily be meeting recommended fitness goals, but by wearing an activity tracker they were showing that they were making an effort.

*I don't know, not like a health nut, but like healthier and active like they care about their health and their fitness and that kind of stuff. - COL2*

*They would just think that I am trying to be more active I tend to think that especially like I am always checking my phone to see how many steps I got. – STW2*

In addition, some of the college students mentioned that people who wear activity trackers are athletes or they probably exercise or go to the gym a lot. These college students saw this as distinctive from lifestyle related activity such as walking and climbing stairs, and reported that people with activity trackers were making an *extra* effort to engage in physical activity for health. These college students often talked about being more committed to a fit lifestyle than those who just walked or climbed stairs. This group made references to using activity trackers with more features such as

the heart rate monitor and the built in exercise tracking as examples of how they were different from those who just counted steps.

*She probably goes to the gym a lot, because that's my first reaction when I see people with them. – COL3*

*Definitely that I am an athletic person and especially since I am usually wearing athletic clothing too. – COL4*

### *Social Value*

Many of the young adult participants discussed how the appearance of the wearable activity tracker is what motivated them to get that particular tracker. However, there were differences in how the “look” of activity trackers was discussed among the two educational segments and among female and male participants.

### *Educational Differences*

**STW Young Adults.** STW young adults wanted their tracker to stand out and be visible on their body. Some even discussed making an effort to subtly show off the tracker to friends and even strangers. They talked about how the tracker must be “stylish.” STW young adults reported two images that they felt were projected to the world when wearing their activity tracker: 1) I am modern, and 2) I am successful.

**I am Modern.** Many of the STW young adults talked about being modern, up-to-date, or in touch with popular culture because of their ownership of a wearable activity tracker. Some talked about how wearing an activity tracker signified that they are up with the trends or that they are a millennial.

*I think they would think that I was modern I think it would be like a modern kind of perspective or look, so I think that is what people would think. That is what I think when I see people wearing like tracker things. I think that they are active and they are modern. They are like I am a millennial, like it is a millennial thing. – STW10*

*I think they're a proactive and up-to-date on the go type of person. Yeah up-to-date with trends. - STW15*

**I am Successful.** Many of the STW young adults reported that they felt like having a wearable activity tracker indicated to others that they are successful, smart, or accomplished. Some talked about how having the activity tracker indicated to others that they have money. This group discussed feeling good because they believed that people looked up to them or that people were jealous of them because they had a wearable activity tracker.

*I would think that they're very smart. I think that they like quality. I think that maybe they're creative and they have a job that helps them feel self-realized like they have accomplished something. I think that they might feel that they probably think that I have a lot of money. They probably think that I'm doing a lot better off than what I am really because they feel that it's expensive and they also feel like a sense of maybe pride like she's doing well, she's getting her health under control so I guess pride and proud they may feel that way towards me and envious at the same time. – STW17*

*I feel happy. I feel proud you know I got something that a lot of people want. Wow, she has a watch; she has money because that is what I think of other people that have them. I am like wow they got money because they are expensive. – STW6*

**College Student Young Adults.** College students reported two images that they felt were projected to others as a result of their wearable activity tracker use: 1) I am tech savvy, and 2) I am friendly.

**I am Tech Savvy.** College students wanted a tracker that did not look like a tracker, but rather a watch or smartwatch. Even if they did not have a wearable activity tracker that had the features of a smartwatch it was important that it look like smartwatch so that they would be seen as tech savvy, “techy,” or on top of technology-related trends. Having a smartwatch was an important way to be seen as more efficient and organized, which was a sign of being someone interesting.



*Probably tech savvy, I mean, yeah, just probably more tech savvy. – COL32*

*A little bit more like I know technology rather than I am trying to track my steps or something. – COL33*

In addition, many college students chose a certain brand because that brand identity corresponded with their personal style or beliefs. Some talked about being loyal to a specific brand (primarily Apple and Samsung) because their identity was associated with being a member of this group. The Apple Watch was discussed by many college students as their top choice of activity tracker technology, and those who did not already have one talked about aspiring to upgrade their device to this product.

*I'm just a big Apple person. – COL4*

*Well ideally I would want the Apple Watch. One of my friends just got and she loves it, and I always peer over her shoulder to see what she is doing on it. So I think in an ideal world I hopefully maybe in the next year I'll get an Apple Watch. – COL13*

**I am Friendly.** Some college student young adults felt a wearable activity tracker indicated to others that they are friendly or outgoing. These comments centered on making new friends. They discussed how seeing someone else with a wearable activity tracker made them feel connected to that person and how it sometimes gave them confidence to approach that person as they already knew they had something in common.

*They think I am pretty outgoing, pretty much active, and good to be around. I presume they are also friendly and I usually want to ask them about it and we become friends – COL23*

*They have similar interests to me, like they care about their health and how much they're active. – COL24*

*Gender Differences*

**Female Young Adults.** Many of the female participants reported that their wearable activity tracker was chosen because of its ability to fit with their personal style or look. A number of female participants discussed the need for the tracker to look feminine, to look like jewelry, or to be a certain color in order to be an acceptable choice. These participants indicated that while they cared about the health aspects of the tracker the most important consideration was how it fit with their style and appearance. Some reported switching trackers because they were not wearing the original tracker they purchased due to the tracker not fitting their personal style.

*It's Pink, that's my favorite color. I wear, so yeah it kind fits, it fits my work clothes, it fits my workout clothes so most of my clothes that I wear are Pink or Rose Gold or Pinkish. – STW15*

*I like that the design is better than a Fitbit. A Fitbit looks very manly and I ended up not wearing it as much as I had hoped to wear it. So I like the UP because it looks more feminine. It looks like a bracelet pretty much. – COL7*

**Male Young Adults.** Some of the male young adults also reported that the tracker fitting with their personal style was important to them. However, they discussed aspects such as their desire for the device to have a good display screen or work with different types of attire (e.g. business, street clothes). Overall, the style aspects seem less important to this group than the female participants.

*I mean most young people like to have the newest technology and stuff like that. That's why I bought it. It looked cool and it done things that a normal watch wouldn't do. – STW14*

*It was definitely the aesthetics. I thought it had a good display. – COL17*

## **Discussion**

Wearable activity trackers are part of growing consumer market of health and fitness products that are popular with young adults. This study explored the beliefs that

young adults hold regarding how wearable activity trackers contribute to their self-presentation, and how they believe these devices help them to manage the impressions that they make upon others regarding their health and social identity.

The purchase of consumer goods for reasons beyond their functional utility has already been established as a way to display identity within social circumstances.<sup>124,125</sup>

An interesting aspect of wearable activity trackers is that they are typically worn on a highly visible part of the body. Therefore, similar to other consumer items such as clothes, shoes, and jewelry, they can be used to represent status or membership in a specific in-group.<sup>127</sup> This is known as conspicuous consumption.<sup>124-126</sup> The various identities that young adults associate with wearable activity trackers indicate that they are an investment in terms of status and impression management as they allow young adults to declare membership in multiple in-groups through a single accessory.<sup>132</sup>

STW young adults associated owning a wearable activity tracker with being modern and a millennial. The Pew Research Center found that young adults identify technology use as the most important and unique characteristic of their generation.<sup>74</sup> Therefore, wearing an activity tracker is a way to show that they are in touch with the priorities of their generation, the ultimate in-group. These devices may also represent an aspirational status for STW young adults. For example, STW young adults discussed how wearable activity trackers made them seem like they had money, yet over half reported that they did not have money left over at the end of the month. Having the disposable income to purchase a device was seen as an important way to show people that they were successful and accomplished. Subcultures have distinct styles, behaviors, and interests and youth subcultures such as commercial youth subculture, provide a

space to express one's identity free from the restrictions of class, school, or occupation for a temporary period.<sup>128</sup> In young adulthood when these socioeconomic factors are in flux, owning a wearable activity tracker may help STW young adults feel more connected to their college student counterparts who they may see as higher achieving or to their older co-workers who they may see as more secure and established in their careers.<sup>128,135</sup> In addition, some of the STW young adults discussed feeling accomplished about having a product that others in their social group did not own. Social identity theory proposes that people that are a part of a group often engage in social comparison that results in criticizing those who are not a part of the group. By owning an aspirational product, STW young adults may be setting themselves up to be at the top of their social group or to move between social groups more easily.<sup>136</sup>

College students reported that wearable activity trackers indicate that a person is techy and friendly. As mentioned above, technology is seen as a unique hallmark of their generation, but college students took this concept even further describing aspirational brands of technology that indicated a higher status. For some college students these devices indicated that they were elite in terms of fitness, and for others the devices indicated social status. Fitness culture in the US is continuing to grow, and marketing of fitness brands and products as status symbols has created a new surge in the status of the fit person identity.<sup>137</sup> Being connected to technology, especially aspirational brands that also convey this fitness identity may be an important part of impression management for young adults with more expensive and aspirational brands such as Apple and Samsung holding higher esteem. College students also reported that having an activity tracker indicated to others that they are friendly or outgoing. They

saw this as a way to indicate similar interests with potential friends. This time in the lifespan is transitional and young adults are often trying to find their place in the world.<sup>8,9</sup> The transition to college can be difficult as most young adults are starting over in terms of their social network. Therefore, the conspicuousness of wearable activity trackers may help ease the transition into a desired group by signaling their membership.

While both male and female participants indicated that the aesthetics of the tracker were important, female participants placed much more emphasis on the look of the activity tracker than males making specific statements about the need for their wearable activity tracker to look feminine or like jewelry. This could be because female gender identity is more closely tied to physical appearance, and for some wearable activity trackers are viewed as part of their look or as a fashion accessory.<sup>129</sup> Furthermore these devices could simply be another example of how fashion and health intersect in modern society.<sup>138</sup>

Young adults reported a number of ways that wearable activity trackers allowed them to present themselves as healthy, active, or fit. Most of the young adults reported that they felt as though they embodied the healthy lifestyle that they were signaling through the wearable activity tracker use. Some of the participants may have adopted the healthy behaviors, while others were still working on developing these health behaviors. Either way, young adults can benefit from developing these health-oriented identities as identity change theory shows that a conflict between health goals and behavior can initiate behavior change. If a behavior change occurs then this can cause an identity shift that will further strengthen the new behavior.<sup>136</sup> Furthermore, even if a

young adult purchases a device as a social status related impression management tool they may still experience health benefits as they may be motivated to live up to their self-constructed identity. Over time this could result in the permanent adoption of that health related identity that in turn supports continued maintenance of the health behavior. Conversely, some young adults who own these devices could adopt the social identity, but never the behavior.

This study had several limitations. This study was designed to provide preliminary research in an area where little research exists. Further research should be conducted regarding wearable activity trackers and their role in both college and STW young adult populations. More college students than STW were recruited to the study and over half of the sample identified as white and female. Efforts to recruit more STW, male, and minority participants were made by continuing targeted recruitment past saturation and using online interviews to reach a more diverse group. However, a more diverse sample could provide new information that would be useful to health promotion practice and research. As with all qualitative research, the goal of this research is not to generalize to a larger population, but rather to garner in depth information about a specific group. Therefore, more research should be conducted to further explore these topics. In addition, expanding research into young adult college graduates would add additional information to the literature regarding this important stage in the lifespan.

In conclusion, the young adults in this study were utilizing these devices to manage their health, but they were also using them to manage their social identity. This could potentially be a positive development for health promotion as identity can play a

role in the adoption and maintenance of health behaviors.<sup>136</sup> The findings from this study highlight a need to better understand the intersection of health, technology, and fashion. Health promotion should consider the health-related and social influences that guide the choices that young adults make in this critical time period. A better understanding of this phenomenon could provide a pathway for health promotion to capitalize on the influence that popular culture currently has on health-related activities.

### **Manuscript 3: Wearable Activity Tracker Use in Young Adults: A Social Cognitive Theory Perspective**

#### ***Abstract***

**Background:** Wearable activity trackers are being adopted by young adults ahead of research regarding their utility as health promotion tools. **Methods:** This study conducted individual interviews with young adults (n=57) who were currently using a wearable activity tracker. Interviews explored how young adults adopt and use wearable activity trackers using Social Cognitive Theory. Typical case sampling was used to recruit college students (n=35) and straight-to-work (STW) young adults (n=22) for an in-person or online interview. Interviews were recorded, transcribed, and analyzed using NVivo. **Results:** There were few differences between college student and STW young adults. Most reported little knowledge of the health benefits/risks associated with their health behaviors, but high expectations as to how the wearable activity tracker would assist them in developing or maintaining the behavior. Self-regulatory aspects of activity trackers such as the self-monitoring, built-in goals, and feedback were seen as benefits. Many reported not setting any goals independent of the device. Most reported increased self-efficacy as a result of their wearable activity tracker use and viewed their device as positive non-judgmental support for their health behavior. **Conclusions:** Wearable activity trackers could be an effective behavior change tool when used in conjunction with theory-based health promotion programming. Young adults are motivated to change or maintain health behaviors, but may need some additional support related to their health knowledge, expectations, and goal setting.



## ***Introduction***

Obesity in the United States is a serious issue that contributes to morbidity and mortality.<sup>1,2</sup> Current statistics indicate that obesity affects one in three adults in the US, with approximately 30% of adults aged 20-39 classified as obese.<sup>1-3</sup> There are three primary health behaviors that are associated with obesity in the US: 1) physical inactivity, 2) sedentary time, and 3) poor nutrition. Each of these behaviors may independently contribute to the development of obesity or the health issues related to obesity.<sup>3</sup> For many years public health has focused on behavioral interventions and health communication campaigns intended to change the obesity-related health behaviors of adults.<sup>50,51</sup> However, in recent years a shift to more comprehensive approaches such as using the ecological model to target multiple levels of influence or using the life course perspective to target obesity across the lifespan have been used to expand the reach of health promotion programming.<sup>4-6</sup>

Young adulthood (18-29 years old) has been identified as an important developmental period, especially in terms of the establishment of health behaviors.<sup>7-9,59</sup> Young adulthood is a time in the lifespan that features demographic changes that may create significant personal instability.<sup>8</sup> For example, young adults may experience diverse living situations, cycles of college attendance, moving into and out of the workforce, marriage, and parenthood. These changes are all marked by increasing responsibility, independence, and decision making.<sup>7,8</sup> This increased autonomy can play an important role in the development and maintenance of personal habits which are likely maintained into adulthood.<sup>8</sup>

Young adults are “digital natives” as they have been using technology their entire lives, and often turn to technology for information and assistance.<sup>10-12</sup>

Approximately 60% of US adults report that they track their weight, diet, or exercise and one in five of these adults report that they use some type of technology to assist them in tracking their health.<sup>118</sup> Young adults spend approximately 3.2 hours per day on their smartphone and are significantly more likely than older adults to use technology to help them track their health.<sup>116,120</sup> While research on smartphone compatible technology such as health and fitness applications (apps) has been going on for several years,<sup>13,17-19,72</sup> research on newer technology including wearable activity trackers is limited.

Wearable activity trackers (i.e. activity monitors, fitness trackers, fitness monitors, wearables, and smartwatches) are devices that are worn on the body (typically the wrist) that have an app that links with the device to report activities such as steps, sleep, heart rate, and calories burned. They are often defined using the following criteria: 1) the device is designed to be worn on the user’s body, 2) the device uses an accelerometer, altimeter, or other sensors to track the user’s movements and/or biometric data, and 3) the device uploads activity data to an online application that shows trends over time.<sup>40</sup> These wearable devices were a \$10 billion industry in 2016 with projected growth as high as \$17 billion by 2020.<sup>122</sup> Despite the growing popularity of these technologies little research has explored individual adopters’ perceptions of wearable technology. Additionally, there is minimal information available regarding how adopters use this technology for health purposes.<sup>18</sup> Thus the purpose of this

qualitative study was to explore how young adults adopt and use wearable activity trackers for health purposes.

### ***Methods***

This study used the qualitative approach of individual interviews to explore wearable activity tracker use in young adults. The study was guided by the Pragmatic Theory of Truth (Pragmatism), Social Cognitive Theory (SCT), and a review of the established literature.<sup>24,89</sup> Pragmatism is aimed at gathering timely and practical information, and provides the qualitative foundation for the exploration of this emerging behavior. Social Cognitive Theory is an established health promotion theory. The creator of the theory, Albert Bandura, has outlined how Social Cognitive Theory (SCT) can be utilized for health promotion purposes, and identified which constructs best fit with health promotion.<sup>89</sup> In addition Bandura placed a special emphasis on how SCT can be used in conjunction with interactive technologies to increase the scope and impact of health promotion programming.<sup>89</sup>

### ***Question Path Development***

The development of the interview question path was an iterative process. Questions were developed based on the reviewed literature and guided by SCT theory. They were then formatted and ordered to elicit the most in-depth responses possible.<sup>25</sup> After the question path was reviewed multiple times it was tested with a convenience sample of young adults to review the wording of questions and identify additional questions that should be asked. Two questions and additional probes were revised based on the convenience sample comments. All study materials and protocols were approved by the University of Oklahoma Institutional Review Board prior to data collection.

## *Sampling*

This study utilized typical case purposive sampling.<sup>24,90</sup> The purpose of this sampling structure is to describe a range of responses of what is typical within the behavior of interest.<sup>24,90</sup> This sampling does not aim to produce generalized statements about young adults but rather in-depth examples of typical cases.<sup>90</sup> A saturation sampling strategy was also employed. Saturation sampling is a qualitative sampling strategy where participants are continually recruited to the point of redundancy when no new information about the theoretical constructs is heard by the interviewer.<sup>24,25</sup> For this study young adults were segmented into two subgroups: 1) straight-to-work young adults (those who went straight-to-work from high school), and 2) young adult college students. Of these two groups college students are more often researched due to the ease of recruiting within an institution. However, both segments should be sampled as they may experience young adulthood differently resulting in diverse knowledge, influences, and beliefs which may impact health promotion programming. Therefore, for the straight-to-work (STW) young adults, not attending college and possessing a wearable activity tracker were the characteristics used to determine a typical case. For the college student young adults being enrolled as an undergraduate student and possessing a wearable activity tracker were the characteristics used to determine a typical case. Inclusion criteria for college students were: 1) be between the ages 18-25, 2) live in the US, 3) currently be using at least one wearable activity tracker, and 4) be currently enrolled in college as an undergraduate. Inclusion criteria for STW young adults were: 1) between the ages of 18-29, 2) live in the US, 3) currently be using at least one wearable activity tracker, and 4) must not be currently enrolled in college, graduated

from college, or attended college for longer than 1 semester. For college students the age was limited to 25 rather than 29 since the goal was to recruit typical undergraduate students.

### *Recruitment*

Two recruitment strategies were used. First, participants were recruited through posters in local businesses that were identified by the convenience sample used to test the question path (e.g. coffee shops, restaurants, bars, entertainment venues). Second, young adults from across the continental United States were recruited via online message boards (i.e. Craigslist, Reddit). Participants meeting the inclusion criteria were scheduled for an interview either in person or online.

### *Data Collection*

In-person interviews were conducted in a number of locations (e.g. coffee shops, bookstores, libraries) and the preferred interview location was chosen by the participant. Online interviews were conducted using Google Hangout. Prior to the interview each participant was given the informed consent. In person participants received a hard copy and online participants were given a link where they could electronically agree to the study. Because many young adults have never participated in research the interviewer also provided a verbal description of the interview process and gained verbal assent before proceeding with data collection.

Participants were given a brief demographic questionnaire prior the interview. In-person participants were given a hard copy to complete. For online participants the interviewer read the questions to the participant and marked their answers on the hard copy. The interview question path included a number of questions that were guided by

Social Cognitive Theory (SCT). These questions focused on knowledge, self-efficacy, outcome expectations, self-regulation, and facilitators/barriers. They were also asked about their behavior prior to acquiring the device and their current behavior. All interviews were recorded using two devices to ensure that the interview was captured. Once the interview was completed the recordings were uploaded to a secure device. Once the upload was confirmed the recordings on the portable devices were erased.

### *Data Analysis*

The recordings were transcribed verbatim, checked for accuracy, and loaded into the qualitative research software NVivo (version 11.0) qualitative research software analysis. A team of three researchers analyzed the data. Utilizing a three person team allowed for analyst triangulation.<sup>24,25</sup> Analyst triangulation is a qualitative process where multiple analysts with different disciplinary perspectives and training are used to analyze data. This process helps to reduce the potential bias that may come from one person conducting all data collection and analysis.<sup>24</sup> An initial codebook was developed by: 1) reviewing previous literature on the topic, 2) listening to the interview recordings, and 3) reading through the transcripts multiple times. Once a preliminary codebook was established the research team reviewed the codes and coded 8 interviews (4 STW and 4 COL) together. The codebook was then modified to change code definitions, combine redundant codes, and add additional codes. The team then chose 10 interview transcripts (5 STW and 5 COL) to code independently and compare. This aided in establishing that all the coders were applying codes consistent with the established definitions.<sup>24,25</sup> After these comparisons all remaining coding was completed independently. Coder agreement was calculated for the two primary coders

for the project (MG and MKC). Coder agreement was 97% (STW) and 98% (COL) for the transcripts coded individually. Upon completion of coding the team met to discuss any discrepancies or disagreements about coding and to come to consensus prior to moving to theme identification.

Theme identification began with the research team working independently to identify themes and checking to see if they met the a priori threshold. An a priori threshold of 25% was established to lend to the credibility of the themes identified in the research. By establishing a threshold that requires a certain number of participants to mention a specific topic before it can be considered a theme eliminates the risk of reporting a topic as a theme when only one or two participants may have said it.<sup>18,91,92</sup> This reduces the risk of reporting themes that are not representative of a typical case, which is ultimately the goal of the research. After theme identification was complete the team came together to discuss themes and subthemes. Once themes were finalized, quotes that represented each theme were pulled from transcripts to provide support the theme statements.<sup>24,25</sup> Finally the transcripts were reviewed for disconfirming evidence of the established themes. Disconfirming evidence of a theme may result in the identification of contrasting themes that should be reported or may result in the need to qualify a theme by reporting that there were some cases that did not support the theme.<sup>25,88</sup>

## ***Results***

### ***Demographics***

The sample was made up of 57 young adults with 35 (61%) college students and 22 (39%) straight-to-work young adults. Participants were from across the US with 35 (61%) from the Northeast (NE), 4 (7%) from the Northwest (NW), 4 (7%) from the

Southeast (SE), and 14 (25%) from the Southwest (SW). STW young adults (n=22) had a mean age of 26. Seventy-three percent of the STW young adults were female, and 50% of them identified as a minority. In terms of education 55% had a high school diploma. College students (n=35) had a mean age of 21 and the majority (73%) were upperclassmen. Sixty percent of the college student young adults identified as female, and a 35% identified as a minority.



**Table 4: Participant Demographics (n=57)**

	<b>College Student (n=35)</b>	<b>Straight to Work (n=22)</b>
	<b>Number (%)</b>	<b>Number (%)</b>
<b>Location of Participant</b>		
Northeast	22 (63%)	13 (59%)
Northwest	1 (3%)	3 (14%)
Southeast	3 (8%)	1 (4%)
Southwest	9 (26%)	5 (23%)
<b>Gender Identification</b>		
Male	14 (40%)	6 (32%)
Female	21 (60%)	16 (73%)
<b>Age</b>	<b>Mean = 21</b>	<b>Mean = 26</b>
18-19	4 (11%)	2 (9%)
20-22	22 (63%)	6 (27%)
23-25	9 (26%)	14 (64%)
<b>Ethnicity</b>		
White/Caucasian	23 (65%)	11 (50%)
Black/African American	3 (9%)	4 (18%)
Latino(a) / Hispanic	3 (9%)	4 (18%)
Asian	6 (17%)	3 (14%)
<b>Education Level</b>		
High School Graduate		12 (55%)
Technical School Graduate		10 (45%)
1 <sup>st</sup> Year College	2 (6%)	
2 <sup>nd</sup> Year College	7 (20%)	
3 <sup>rd</sup> Year College	11 (31%)	
4 <sup>th</sup> Year College	11 (31%)	
5 <sup>th</sup> Year College	4 (11%)	
<b>Employment Status</b>		
Full-Time	2 (6%)	13 (59%)
Part-Time/Temporary	18 (51%)	6 (28%)
Don't Work Right Now	15 (43%)	3 (13%)
<b>At The End of the Month</b>		
Money Left Over	18 (51%)	8 (36%)
Just Enough Money	17 (49%)	10 (45%)
Still Have Bills to Pay	0 (0%)	4 (18%)

### *Description of Wearable Activity Trackers*

All of the wearable activity trackers used by the sample of young adults tracked the distance walked, and most tracked other metrics such as stairs climbed, sleep, and calories burned. In addition many of the activity trackers offer other features such as heart rate monitoring, competitions, workouts, ability to connect with others using the device, and notifications such as reminders.

**Table 5: Participant Technology (n=57)**

	<b>College (n=35)</b>	<b>STW (n=22)</b>
<b>Question</b>	<b>Number (%)</b>	<b>Number (%)</b>
<b>Number of Three Closest Friends w. Activity Trackers</b>		
0	2 (6%)	3 (14%)
1	10 (29%)	13 (59%)
2	11 (31%)	2 (9%)
3	12 (34%)	4 (18%)
<b>Type of Wearable Activity Tracker</b>		
Fitbit	26 (74%)	13 (59%)
Apple Watch	6 (17%)	2 (9%)
Samsung Gear	0 (0%)	3 (14%)
Other	3 (9%)	4 (18%)
<b>Number of Wearable Activity Trackers Owned</b>		
1	31 (89%)	20 (91%)
2	4 (11%)	2 (9%)
<b>Length of Use</b>		
1-6 Months	11 (32%)	12 (54%)
7-12 Months	12 (34%)	7 (32%)
> 1 Year	12 (34%)	3 (14%)
<b>Reason for Purchase</b>		
Support Existing Behavior	14 (40%)	9 (41%)
Establishing New Behavior	14 (40%)	8 (36%)
Not Behavior Related	7 (20%)	5 (23%)

Most of the young adults reported that they purchased the device to help them maintain or adopt a health behavior, but some reported other reasons for purchasing the

device (e.g. trendiness of the device, other features such as text notifications). For most of the young adults physical activity was the primary behavior they were attempting to maintain or change, but sleep was also mentioned as an important behavior to change. Some made broader comments such as having a “healthy lifestyle” or being “more active” as the primary reason they purchased the device.

Social Cognitive Theory (SCT) provided a framework for exploring the existing use of wearable activity trackers by young adults. Bandura has provided guidance on utilization of SCT for health promotion, in this guidance he focuses on core determinants of health practices these include: knowledge of health risks and benefits, perceived self-efficacy, outcome expectations, goals, and perceived facilitators and impediments.<sup>89</sup> The themes presented here are organized using SCT constructs with an emphasis on these core determinants.

**Table 6: Social Cognitive Theory Constructs**

<b>Construct</b>	<b>Operational Definition</b>	<b>Key Findings</b>
Knowledge	What health benefits and risks did young adult wearable activity tracker users associate with their target behavior?	Young adults struggled to define benefits/ risks of the health behavior. Young adults reported emotional benefits of health behavior more often than physical benefits.
Perceived Self-Efficacy	Did young adults report that their wearable activity tracker impacted their confidence in their ability to control their target behavior? How did they believe it helped them?	Young adults reported that the wearable activity tracker boosted their confidence in their ability to meet health goals.
Outcome Expectations		
Physical Outcome Expectations	What expectations did young adults have regarding the physical outcomes of using the wearable activity tracker?	Young adults expected that the wearable activity tracker would have a positive impact on their health behavior.

Social Outcome Expectations	What expectations did young adults have about what others would think of their wearable activity tracker use?	Young adults reported that others would support their wearable activity tracker use.
Self-Evaluative Outcome Expectations	What expectations did young adults have about how they would feel about themselves if they did or did not use their wearable activity tracker?	Young adults reported that they experienced a self-esteem boost when they used the activity tracker but avoided it when they were not meeting their goals.
<b>Self-Regulation</b>		
Self-Monitoring	How do wearable activity trackers allow young adults to observe their own behavior?	Young adults reported that the wearable activity tracker provided a number of ways to self-monitor, which was seen as a way to be more accountable.
Goal Setting	How do wearable activity trackers help young adults identify short and long term goals	Young adults used the goals built into the wearable activity tracker, but these were primarily short-term goals.
Feedback	How do wearable activity trackers provide information about how they are doing and improving?	Young adults appreciated the feedback especially the cues to action and activity trends.
Social Support	How do wearable activity trackers help young adults enlist social support?	Young adults saw the wearable activity tracker as a form of non-judgmental social support.
Perceived Facilitators	What facilitators to wearable activity tracker use do young adults report	Young adults reported that the automatic nature of the device facilitated their health behavior.
Perceived Barriers	What barriers to wearable activity tracker use do young adults report?	Young adults reported that time constraints and responsibilities were their primary barriers.

### *Social Cognitive Theory Related Themes*

**Knowledge.** Young adults were asked what they felt were the most significant benefits of using their wearable activity tracker to maintain or change their health

behavior. Most participants focused on the emotional benefits of their wearable activity tracker use, reporting that they felt better about themselves or felt happier when using the wearable activity tracker. A few participants mentioned physical health benefits such as losing weight or cardiovascular fitness. However, most of the young adults struggled to describe the physical health benefits of using a wearable activity tracker beyond broad statements about feeling healthier or living longer.

*Feeling better about yourself, being happier in general with a better feeling by being motivated like a natural high... – STW10*

*Self-image, which you know just makes you a happier person, and you know I'm just not in as bad of a mood if I feel better about myself. – COL3*

When asked about the health risks of not performing their health behavior, young adults also focused on the emotional impacts such as disturbed sleeping or feeling depressed. Many of the college students mentioned common chronic diseases as a reason for maintaining health behaviors. STW young adults made statements about health, but few named any health conditions. For both groups, those who did mention chronic diseases often related their concern to a family member suffering from diseases such as obesity, diabetes, hypertension, and heart disease and discussed how they were scared of that happening to them.

*My grandparents both have high cholesterol, my mom has type 2 diabetes and those would be like the two biggest things that I would be scared of so just developing something like that. –COL14*

*There is all sorts of health risks especially if you are somebody that gains weight easily that can lead to a whole list of health problems. -STW2*

**Self-Efficacy.** Most young adults discussed how wearing their activity tracker boosted their confidence in their ability to meet personal health goals. For the young adults who reported already engaging in their target behavior the wearable activity

tracker was seen as a way to gain more control over their health habits. These young adults talked about getting the wearable activity tracker as a way to “see” their behavior and described how seeing what they were accomplishing gave them a sense of control over their health.

*It makes you feel so good because it lights up and you get a bunch of little confetti and you're like yes I made my goal for the day and so I definitely think that that helps...I definitely get joy out of that. – COL4*

*It has helped me be more consistent on what I am doing. It helps me keep more detailed information about my health like I said before the steps you take, the calories you are supposed to burn, your active hours and things like that. So it gives me more accountability really for what I do. – STW12*

For the young adults that were attempting to adopt a new behavior the wearable activity tracker was seen as a guide that boosted their confidence in their ability to change their routine. Some participants talked about feeling empowered and more in control because of the wearable activity tracker. Many reported that before they got the wearable activity tracker they were unsure of their ability to accomplish their goals, and that the activity tracker helped them to realize that they could meet their health goals.

*It felt like I was finally working toward something. Most of the time I was just laying around just like letting the days go by, but if you give yourself something to work towards and you finally reach it, that accomplishment feeling, it's really good for your self-esteem. Like, I can do this, I can do things I didn't think I could do. And you want to do more things, challenge yourself. – STW21*

*Immediately it reminds you to set small goals which is helpful so instead of saying gosh I want to try and lose fifty pounds it will say you know try to lose five or ten in the next few months. – COL8*

*It makes me feel encouraged that I can continue to take the journey to allow the Fitbit to help me increase my steps, increase my exercise and well-being overall. – COL6*

**Physical Outcome Expectations.** Young adults expected that the wearable activity tracker would have a positive impact on their health behavior. Those who

purchased a wearable activity tracker after they were already engaged in the behavior expected that it would enhance their existing routine and potentially motivate them to reach beyond their current health goals or status. Some discussed feeling disappointed in the activity tracker and reported that it did not add any value to their routine. These young adults often stopped using the tracker or only used it as a watch.

*I like it less now, I don't know if like is the right word, I was more optimistic and intrigued about its different functions at first but now it's just an accessory to me. – STW5*

*At first it was more of hype of having a fitness or tracking watch or whatever and now it's just a watch that counts my footsteps. – COL34*

Those who reported getting an activity tracker to support them in adopting a new health behavior expected that the wearable activity tracker would “change” their behavior or at minimum provide them with the motivation they needed to accomplish the behavior change. When their expectations were not met they reported being disappointed or losing interest in the device.

*Well at first it changed my daily routine because I used to like to get up and I used to jog and then I feel like the first two weeks went by and I felt like I can't do this right now, this is too much for me so my life is back to regular now. – STW6*

*It lost its appeal. Like at the beginning it was like “oh aw” it was like a shiny new car and you are like yea I love this and then as time goes on you start get mad at yourself because you are like I am not meeting my expectations and you kind of get mad at yourself for not doing it. – COL7*

**Social Outcome Expectations.** Most of the young adults reported that they found out about wearable activity trackers through someone in their social network. Therefore, they expected that they would receive support for their use of the activity tracker. For the majority of participants this was true.

*Well she was happy because I mean she bought it for me as a gift and she was like I really want you to use this cause I got it for but if you don't like it you don't have to but she was just happy that she found a gift, I actually use. – COL1*

However some of the STW young adults reported social disapproval of their wearable activity use from family and friends. These young adults reported that the disapproval was from not understanding the purpose of the wearable activity tracker.

*They think I'm stupid...Everyone that I work with is a middle aged man and so they think I'm just being dumb. But you know as they see it, it's how many steps you take in their mind isn't really important it's just how much you do and how you feel so I just, I like having a little more information, a little more accurate information that is. – STW11*

**Self-Evaluative Outcome Expectations.** Most young adults discussed how wearing their activity tracker increased their self-esteem. The young adults who were supporting an existing behavior spoke about this self-esteem as an unexpected benefit of their activity tracker use and emphasized that it was an important part of their continued use of the activity tracker. Those who were attempting a new behavior reported that when they were meeting their goals they felt proud of their wearable activity tracker use, but when they were “slacking” or not meeting the goals built into the tracker they felt ashamed or disappointed in their behavior. This often resulted in the young adult not wearing the activity tracker or avoiding the information provided by the tracker.

*It feels great. It feels like I really wish it didn't take me this long to decide to get one. I feel like I could have avoided a lot of body hating that I used to do if I had got this motivation sooner. – STW21*

*Now that I've had it for a while I don't really do anything different. I wish I was walking more and using it the way it should be used. – COL11*

**Self-Monitoring.** Many of the young adults discussed how the wearable activity tracker increased their awareness regarding their health behavior and helped them be



accountable to themselves regarding their health goals. Those who were supporting an established behavior reported monitoring their behavior and adjusting their day to meet their goals. These young adults also discussed the ability to monitor trends in their activity over days, weeks, and months as a major benefit of the tracker. This was seen as a way to establish a better understanding of their physical activity patterns and ultimately they felt that viewing activity trends would help them achieve their goals. For those who were hoping to establish a new behavior the wearable activity tracker was viewed as a way to understand their habits and work on correcting their unhealthy or sedentary behavior. Some young adults discussed feeling like they had to have their activity tracker on in order to feel like they were doing something worthwhile, and if they did not wear the tracker there was no reason to be active.

*It has helped me be more consistent on what I am doing. It helps me keep more detailed information about my health like I said before the steps you take, the calories you are supposed to burn, your active hours and things like that. So it gives you more accountability really for what you do. – STW12*

*I like being able to make a chart and see like, plotted on a chart how I'm improving or not improving each day to day over the course of a week or a month. – COL30*

**Goal Setting.** Most of the young adults did not report setting their own goals for physical activity and sedentary behavior. Instead they used the goals built into the wearable activity tracker. Most of these goals were primarily daily goals such as steps, calories burned, flights of stairs climbed, and active minutes. Many reported consistently meeting these goals, but few reported considering how to adjust goals to accommodate their progress. When asked about long-term goals very few young adults could articulate any goals beyond their daily or weekly goals. Most reported that they just want to “be healthy” or “stay active”.

*I left the goals it had which were hard to achieve but I was like well, what is a goal if it is easy you know so I just left it at the 10,000. I kept the floors the floors I think [referring to flights of stairs]...but I kind of keep my calories or try to keep the goals like the standard goals that they have for me. – COL9*

*[In response to question about long-term goals] Definitely want to be healthier. Definitely I want to be closer to my goal weight, be more active, physically fit, so I can you know breathe better you know just be more active – STW15*

*Really, I just like to be able to compare what yesterday and last week was like compared to today and potentially next week. I like to be able to see what progress I've made. – STW22*

**Feedback.** Most of the young adults reported that the feedback from their wearable activity tracker was beneficial to meeting their health goals. The young adults supporting an existing behavior reported appreciating the feedback on their activity trends. For the young adults who were focused on adopting a new behavior the cues to action were seen as important reminders to engage in their health behavior. The most reported cues to action were the visual cues that can be seen on the face of the device (e.g. number of steps, calories burned), and the vibrations to get up and move.

*Yea it's a lot more satisfying I guess when you can like see the results on your screen or when all of the dots are up on my Fitbit or it says that I have 10,000 steps. – COL2*

*I like the fact that you know as you are hitting or you are getting closer to your goal the color of the bar changes to kind of like it goes from red and then it slowly moves to orange and then it slows to green so it just kind of gives you that more motivation as you see the colors change. - STW2*

**Social Support.** Most young adults reported that their wearable activity tracker use was supported by family and friends. However, when it came to sharing goals and receiving feedback, encouragement, and positive reinforcement most of the young adults discussed the wearable activity tracker providing this function rather than a friend

or family member. Many of the young adults talked about their wearable activity tracker as their guide, assistant, buddy, partner, and even trainer.

*I think that an activity tracker provides you with the moral support that you may need from like a friend or a peer or a family member, it helps you to build the confidence that you need to get moving doing something and becoming active for the long term because sometimes you want to like rely on a buddy or friend or family member...but people tend to be very flaky or unreliable so this helps you by giving you the support that you need. – STW17*

*Yeah it's like an assistant. It's kind of like the Siri for my fitness. It's like a buddy. It's kind of like my mobile you know every day, every hour um trainer. It isn't judgmental but I guess it kind of helps me celebrate milestones. STW15*

Those who were attempting a new behavior discussed how the wearable activity tracker supported them without judgement. The positive messages that the activity tracker shared with them such as “way to go” or “you met your goal” were seen as valued encouragement and support for their behavior.

*I really like the updates I get if there's been a lot of movement...it'll notify you on your watch and say, “Hey, good job! Keep it up! You've been moving! You've burned so and so this many calories!” So, that actually is really cool cause I'm like, “Okay, great.” It makes me keep going. So, I like that feature about it. – STW20*

*It makes me feel good like I kind of I need that kind of I needed somebody in my corner without having literally having somebody in my corner just telling me to get up and go and this is what I need because I would like to be pushed but I don't like it at the same time. Like I don't really like being told what to do but this kind of it feels like I am telling myself to do it just because I have a reminder like this. – COL9*

**Facilitators/Barriers.** Participants were asked about the facilitators and barriers to their tracker use. Most of the participants were using health and fitness applications (apps) prior to their activity tracker use, and they discussed the benefits of connecting their apps (e.g. MyFitnessPal) to their wearable activity tracker. This was seen as a positive way to integrate all their health activities into one place, and they believed that

this made it easier for them to stay on track with their health goals. Many also reported that the wearable activity tracker was low maintenance and easy to use. Most reported that the device automatically logging their activity was the most important feature that facilitated their health behavior.

*Yea it's really positive it makes me feel like I have a bit more control of my life just because it is automatically counting things you know I don't have to write anything down in a log book or anything and it takes something off my plate basically. – COL8*

*I like that it's easy to turn on and off...I like that it's simple. - STW21*

Since most young adults reported physical activity as their target behavior the discussion regarding barriers often centered on barriers related to being active such as time, other commitments, and stress. Many of the college students reported that there were no significant barriers to their use other than lack of motivation to use the device.

*I think being lazy no just not wanting to get off of my butt and workout. – COL6*

College students who did report barriers focused stress or busy times during the semester such as midterms and finals.

*I guess it's just like I don't have too much time to [use it] at school there's lot of other things I'm worrying about... – COL15*

STW young adults reported that work, children, and family obligations were the biggest barriers to use and discussed how they often felt overwhelmed by their inability to control these barriers. Losing interest in the wearable activity tracker was also mentioned by many of the STW young adults as a reason why they stopped performing the health behavior. They mentioned the “new wearing off” or becoming bored with it after a while.

*The business of life, having kids. – STW22*

A few STW mentioned the look of the wearable activity tracker as a barrier to use reporting that it did not go with their work clothes or that it was too masculine.

*I found that anytime I wore anything nicer I was pretty much like not wearing it which is kind of defeating the purpose of having one. - STW7*

### **Discussion**

This study explored young adults' perceptions of wearable activity trackers in relation to Social Cognitive Theory (SCT) constructs. Wearable activity trackers are popular among young adults and data shows that their use will likely continue to grow.<sup>122</sup> Health promotion specialists have an opportunity to capitalize on the popularity and availability of these devices by using them to help young adults develop or maintain positive health behaviors during this critical time in the lifespan. However, young adults have a complex relationship with technology and health promotions specialists should avoid making assumptions about how young adults use these devices. For example, 20% of the young adults in this study reported purchasing their wearable activity tracker for reasons other than health. Exploring *existing* use of wearable activity trackers provides an opportunity to understand how young adults interact with these devices independent of the external influences that are created in previous studies when researchers provide devices to study participants for utilization.<sup>19</sup>

Health behavior has been linked to education, and understanding the benefits and risks of a health behavior can play an important role in the development and maintenance of the behavior.<sup>139,140</sup> The majority of the young adults (college and STW) in this study did not link their health behavior to a specific health outcome. While it is encouraging to see young adults reporting on the positive emotional benefits of their health behavior, it is concerning that a clear understanding of how their behavior may

impact their long-term health was not present. Most of the young adults reported using their wearable activity tracker for less than a year, yet many already reported reducing their use of the device to 4 to 5 days per week. This relatively short duration of use combined with a lack of understanding of the benefits/risks of their health behavior may increase the likelihood of discontinuation once the novelty of the device wears off. This particular finding provides an opportunity for health promotion practitioners to explore ways to develop health communication and programming to aid existing users in maintaining consistent use through developing a better understanding of the impact of health behaviors on their long-term health. Targeting existing wearable activity tracker users that are already motivated to change or maintain behavior may provide an opportunity for a small effort to garner significant long term results.

Young adults have a complex relationship with technology that results in high expectations of what technology can do for them. The young adults in this study reported a number of physical, social, and self-evaluative expectations related to their wearable activity tracker use. When those expectations were not met, the young adults reported reduced or discontinued use of their device. Managing young adult expectations as to what this technology is capable of when it comes to health behavior may be an important consideration for health promotion research and programming that opts to use this technology.

Young adults also discussed how the activity tracker was a form of non-judgmental support, which they may see as an alternative to enlisting social support from family and friends. During this time in the lifespan young adults are beginning to expand their relationships to include people that they choose to interact with such as

peers in school or co-workers.<sup>9,135</sup> Receiving social support from the activity tracker during a time when their support system and social circumstances are in flux may alleviate the need to bring up deeply personal health goals in new relationships or outside of established close personal relationships. In addition, exploring the use of technology-based social support could yield valuable information as to whether or not this additional form of support is useful for behavior change or maintenance.

Bandura indicates that self-efficacy directly influences behavior and the other constructs in the SCT.<sup>4,89</sup> In addition, he emphasizes that there are multiple levels of self-efficacy. These range from high self-efficacy which requires minimal guidance to low self-efficacy which requires structured mastery and social modeling.<sup>4</sup> The young adults in this study ranged from those who had already established behavioral goals and habits to those who were attempting new health behaviors for the first time. A positive finding from this research is that despite these differences all of the young adults reported that owning a wearable activity tracker increased their confidence in their ability to meet their health goals. In particular, the self-regulatory aspects of the wearable activity tracker such as the built-in goals, ability to self-monitor, and the feedback from the device were all seen as facilitators of their behavior. In contrast to the typical burdens of young adulthood such as increased independence, responsibility, and decision making these devices provide reasonable goals, positive encouragement, and feedback without much critical thinking on the part of the young adult.<sup>135</sup> The preset features of the wearable activity tracker may be useful in reducing the perceived burdens upon young adults, but may fall short in terms of increasing goals as young adults' progress in their health behavior. Health promotion researchers and practitioners

may benefit from exploring how to utilize these popular components of wearable activity trackers to help young adults develop a low maintenance routine that focuses on enhancing self-efficacy. Then if the novelty of the device wears off there is still a chance that the young adult will continue the behavior. In addition, future explorations of how to get young adults to continually increase goals as they progress in the mastery of their target behavior will be an important method that health promotion programming to support behavior change and maintenance through wearable activity tracker use.

This study had several limitations. This study was designed as formative research of typical cases of young adult wearable activity tracker use meaning the results are not generalizable, but are meant to provide an in-depth look at this emerging behavior. The sample was predominately white and female. It is unclear based on the information available whether this is simply the user demographics for wearable activity trackers, or a need for more strategic sampling. Future research with a more diverse sample could provide further insights into the use of wearable activity trackers in young adults. The sample was limited to young adults who did not go to college and those enrolled as undergraduates. It is possible that graduate students and college graduates who are still in young adulthood may have different experiences than those in undergraduate programs.

In conclusion, young adults are adopting and utilizing wearable activity trackers without the assistance of health promotion programming. Research had yet to explore young adult perceptions and experiences with these devices. This study focused on young adult perceptions using Social Cognitive Theory as a guide for questions. Young adults reported little knowledge of the health outcomes associated with their behaviors



and high expectations of their wearable activity tracker. They also reported increased self-efficacy as a result of their wearable activity tracker use and believed that their device provided them with positive non-judgmental support. This information provides a starting point for health promotion researchers and practitioners who want to capitalize on this technology for health promotion activities.

## **Chapter 5: Discussion**

### **Purpose of the Research**

Young adulthood is a critical time for the development of health behaviors.<sup>135</sup> Young adults are lifelong users of technology and have often been called digital natives because they have never experienced life without technology.<sup>12</sup> Young adults report that technology has improved their lives, and that they turn to it for information and assistance related to health.<sup>10,11,117</sup> In addition to its role as a tool, technology may also hold other meanings for young adults that can influence its ability to impact their health. Young adults are adopting technologies such as health and fitness applications (apps) and wearable activity trackers that offer a number of features designed to impact health. However, they are utilizing these technologies ahead of research regarding their utility and/or effectiveness as health promotion tools.

The purpose of these two studies was to explore how young adult adopters use these technologies to change or maintain health behaviors, what meanings these technologies hold for young adults, and how health promotion can utilize these technologies in research and practice. Young adults typically take two pathways after their secondary education: 1) they enter college, or 2) they go straight into the workforce. These two paths can result in different social circumstances, responsibilities, and levels of independence which may result in different experiences and perspectives related to technology use for health. Therefore, this research focused on sampling both college students and straight-to-work (STW) young adults to ensure that both segments' experiences were explored. This study originally intended to focus on both health and fitness apps and wearable activity trackers, but during data collection it was determined

that health and fitness app use was not as common as wearable activity tracker use. Therefore wearable activity trackers will be the only technology reported on for this research.

### **Summary of Findings**

College student and STW young adults both reported adopting wearable activity trackers for health reasons, but also reported that they provided value to them beyond their health-related functions. In terms of health, both groups expected their wearable activity tracker to help them meet their goals and that their social networks would support them in their wearable activity tracker use. Regarding support most reported that they received social support from family and friends for their wearable activity tracker use, but STW young adults reported a few instances when they did not. Young adults also reported that they expected that their wearable activity tracker would help boost their self-esteem, and both groups of young adults reported that using their device did boost their confidence in their ability to perform their target health behavior. Young adults reported that their wearable activity tracker assisted them by offering a number of self-regulatory features such as built-in goals, self-monitoring, and feedback. In addition, they reported that the wearable activity tracker offered them non-judgmental social support. Both groups appeared to have a limited knowledge of how their wearable activity tracker use would impact their health, and very few young adults reported setting health goals independent of the goals built into the wearable activity tracker. Finally, both groups of young adults reported that they would recommend a wearable activity tracker to others.

In addition to health-related value, both groups reported on how they perceived those who use wearable activity trackers and how they hoped others perceived them based on their wearable activity tracker use. They reported that these devices allowed them to present multiple actual or aspirational social identities to the world, while also impacting their self-esteem and motivation to perform their health behavior. For example, both groups reported that wearing an activity tracker signaled to the world that they were health conscious, active, and fit regardless of their activity or fitness level. Some college students took it one step further than STW young adults by reporting that a person seen wearing an activity tracker was viewed as an athlete or that others saw them as an athlete. Beyond the health-focused social identities reported there were additional social identities that young adults reported projecting through their wearable activity tracker. These identities differed for college student and STW young adults. College student young adults reported that wearable activity trackers made them seem tech savvy or connected to the newest and best technology. They also believed that owning a wearable activity tracker indicated to others that they were friendly, outgoing, or approachable. STW young adults reported that wearable activity trackers made them seem modern and connected to their generation. They also believed that by wearing an activity tracker they were indicating to others that they were successful, had money, or were better off than others. Both groups reported that that wearable activity trackers were “trendy” and must adhere to certain aesthetics in order to be acceptable. For the female participants the look of the wearable activity tracker was presented as important with many females discussing how their tracker had to be feminine or look like jewelry.

Additionally, some of the male participants reported that a tracker that looked like a “nice” watch was important to them.

### **Limitations**

This study had several limitations. First this study was formative research on a topic in which little research exists. In addition this study used typical case sampling to recruit young adult with existing wearable activity tracker use. This means that results of this study are not generalizable, but are rather meant to provide an in-depth look at this emerging behavior in order to further the literature on this topic.

The second limitation is that the sample was predominately white and female, which limits the diversity of the typical cases in this study. It is unclear based on the information available about these devices whether this is simply the user demographics for wearable activity trackers, or a need for more strategic sampling. While there were few responses that differed between males and females and no discernable differences in the responses of white participants and other ethnicities there is no way of knowing if a sample with more males or more ethnic diversity would produce different responses. Future research with a more diverse sample could provide further insights into the use of wearable activity trackers in young adults.

The third limitation of the study is that while the sample was recruited from across the entire United States, there were more responses of interest and subsequently more qualified participants recruited from the Northeast US. There is no way of knowing why more young adults from the Northeastern US responded to recruitment posts than young adults in other regions. In addition, while no differences were seen in responses from participants of different regions, there is no way of knowing if there are

any qualitative differences in these young adults and young adults from other regions of the US.

The fourth limitation of the study was that the sample was limited to young adults who did not go to college and those enrolled as undergraduates. Young adulthood is typically defined as the ages of 18-29 and the STW young adult recruitment included the full range of ages. However, for the college student young adults recruitment was limited to just undergraduate students who are typically ages 18-25. There was considerable interest in the study from graduate students and college graduates indicating that they too use wearable activity trackers. It is possible that graduate students and college graduates who are still in young adulthood may have different experiences related to their wearable activity tracker use than those in undergraduate programs. Future research should include this segment of young adults as well.

### **Recommendations for Researchers**

There is very little published research on wearable activity tracker use in young adults. More formative research should be done in order to develop a more thorough understanding of the complex relationship that young adults have with these technologies. Additional studies that segment young adults into college students and STW young adults can help to develop a better understanding of how these two groups may differ, resulting in more opportunities for tailoring programming to fit the needs of young adults. Qualitative studies that focus on additional segments of the young adult population including graduate students and college graduates should also be explored to determine if there are qualitative differences in these segments of the young adult population. In addition exploration of adolescent wearable activity tracker use could

provide valuable information for programming aimed at those entering young adulthood, and may provide information on how to encourage adoption of technology to assist in behavior maintenance or adoption during this transitional time in the lifespan. Furthermore, intervention studies that employ wearable activity trackers in conjunction with theoretically based health promotion programming can provide information to public health practice on how to incorporate wearable activity trackers into theory-driven community-based health promotion. Finally, a quantitative study exploring the demographics of wearable activity tracker use from a research rather than a consumer perspective could provide key insights into who is using these technologies thus furthering the research in the field of wearable activity trackers.

### **Recommendations for Public Health Practice**

Public health practitioners should consider how to utilize this technology for programming with young adults. The popularity and projected continued growth of this type of technology makes it a promising avenue for programming. In particular, the ability to remotely monitor the progress of the participant may prove to be cost-effective and efficient for a field that often operates with limited funds. There is also healthcare-related potential in using these devices to assist young adults who need to monitor or manage an existing health condition. This study indicated that young adults have high, potentially unrealistic expectations of what these devices are able to provide them. They appeared to be reliant upon the device for guidance, monitoring, and goal setting. Programming that can extend the function of these devices by helping young adults manage expectations and set appropriate goals could help them maintain their target behaviors even after the novelty of the device has worn off. In addition, young

adults reported that the device was providing them social support. This was perhaps seen as an alternative to reaching out to their actual social networks. Health promotion programming that extended this perceived social support by providing additional support in the form of a coach or trainer could again help extend the use of the device and performance of the target behavior.

## **Conclusions**

Young adults are using wearable activity trackers ahead of research in this area. These devices provide an opportunity for health promotion research and practice to capitalize on the popularity of wearable technology for health promotion purposes. However, researchers and health promotion practitioners should not make assumptions about what this technology means to young adults and how they will use it. The typical cases interviewed for this study reported that their wearable activity tracker has value to them for health and social purposes indicating that these devices are positioned at the intersection of health, technology, and fashion. It is yet to be determined what these findings mean for the future of these devices and the potential they hold as health promotion tools. Exploration of how to harness their popularity while also using evidence-based health promotion techniques along with more exploration of how young adults develop complex relationships with technology should be considered for future health promotion research and programming.



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## Appendices

### Appendix A: Study 1 Social Cognitive Theory Constructs, Definitions, and Example Questions

Construct	Definition	Example Questions
Knowledge	Awareness of health risks and benefits of different health practices	<p>What are some of the health [risks/benefits] of [behavior]?</p> <p>What are some ways besides using a health and fitness app that people can [behavior]?</p>
Perceived Self-Efficacy	Beliefs about personal ability to control one's health habits	<p>Tell me about your successes with [behavior] before you got the app.</p> <p>Tell me about how those successes made you feel.</p>
Outcome Expectations	The expected costs and benefits for different health habits	<p>Tell me what made you decide to try using a health and fitness app.</p> <p>What did you hope to achieve when you downloaded the app?</p>
Goals	The health goals that people set for themselves and the concrete plans and strategies for helping meet them	<p>What short-term goals did you have for yourself when you downloaded the app?</p> <p>Tell me about who you shared your goal with?</p>
Perceived Facilitators and Impediments	Social and structural issues that can aid or hinder the behavior change	<p>What might happen during your day that would keep you from using your app?</p> <p>Tell me about what you think may have helped you succeed [with behavior].</p>

**Appendix B: Study 1 Type of Questions, Purpose of the Question, and Example Questions**

Type of Question	Purpose	Example Questions
Experience Behavior Questions	Intended to elicit descriptions of experiences, behaviors, actions, activities; what a person has done, seen, heard, or thought.	<p><b>Main Question:</b> So tell me about the behavior that you were trying to change or improve upon when you downloaded this app.</p> <p><b>Follow-Up:</b> Tell me about your history with this behavior.</p> <p><b>Probe:</b> Have you tried to [behavior] before?</p>
Knowledge Questions*	Intended to discover what people consider factual information. What people think is true. Interviewer records, but does not correct misinformation, except at the end of the interview.	<p><b>Follow-Up:</b> What do you know about this app that makes it different from other health and fitness apps?</p> <p><b>Follow-Up:</b> What do you know about the features of this app that make it different from other similar apps?</p>
Opinion/Value Questions	Aimed at how people interpret specific events or issues; answers reflect a decision-making process and may reveal goals, opinions, norms, intentions, desires, and values.	<p><b>Main Question:</b> What did you hope to achieve when you downloaded the app?</p> <p><b>Follow-Up:</b> What short-term goals did you have for yourself when you downloaded the app?</p> <p><b>Probe:</b> Tell me about who you shared your goal with.</p>
Feeling Questions*	Probes emotional responses to experiences. Typically spontaneous, often not the result of a decision, often non-rational. May emerge in responses to other kinds of questions	<p><b>Follow-Up:</b> Tell me about your successes with [behavior] before you got the app</p> <p><b>Probe:</b> Tell me about how those successes made you feel.</p> <p><b>Follow-Up:</b> Tell me about your setbacks with [behavior] before you got the app.</p> <p><b>Probe:</b> Tell me a little about how those setbacks made you feel.</p>

### Appendix C: Study 1 Main Questions Linked to Research Questions

Main Question (Follow-Ups and Probes Not Listed)	Research Question
Ok, now I want you to show me your favorite health and fitness app.	RQ2
Tell me about the behavior that you were trying to change or improve upon when you downloaded this app	RQ1 / RQ3
Tell me what made you decide to try using a health and fitness app	RQ1 / RQ2
Tell me about how long you have been using the app?	RQ1 / RQ3
What did you hope to achieve when you downloaded the app?	RQ1 / RQ2 / RQ3
Tell me about how you think the app has changed your behavior?	RQ3
I want you to think about when you first downloaded the app. Tell me about how often you used the app when you first downloaded it.	RQ1 / RQ3
Let's talk about the features of this app that are your favorites?	RQ1
What particular features of this app are your least favorite?	RQ1
Tell me a little about what types of barriers make it harder for you to use the app.	RQ1
What advice might you give to other young adults that want to use a health and fitness app to change their behavior?	RQ3
What are some of the health [risks/benefits] of [behavior]?	RQ3
What are some ways besides using a health and fitness app that people can [behavior]?	RQ3

## Appendix D: Study 1 Interview Question Path

### Introduction

Thank you for agreeing to take part in this discussion about health and fitness apps

My name is \_\_\_\_\_ and I work with the University of Oklahoma. With me today is \_\_\_\_\_, who will be assisting me during the session.

We are interested in learning more about the health and fitness applications that young adults like you use and why they use them. We've asked you to participate today because you have told us that you use one of the health and fitness apps that we are interested in learning more about.

We're here today to learn from you. There are no right or wrong answers. We want to hear your point of view. We are here today to ask questions and to listen to you.

We would like to record the discussion today because it is impossible to listen to you and take notes and we want to make sure that we don't miss anything you say. This discussion is confidential and no names will be used in our report. Is that ok?

At this time I'd like to ask that you keep your phone out so that we can refer to it, but I would also like to ask you not to check your emails or text messages or answer any phone calls during our discussion.

*\*\*Note: For many questions a list of possible probes are provided. These will be utilized based upon the participant's responses \*\**

### Interview Questions

1. **Main Question:** What I would like you to do is to take out your phone and show me your favorite app that you have on your phone.

**Follow-Up:** It doesn't have to be your health and fitness app, just your favorite one in general.

**Probe:** Tell me about what makes this is your favorite app.

**Probe:** Tell me about how you feel when you use this app.

**Probe:** Tell me about any special meaning that this app has for you.

2. **Main Question:** Ok, now I want you to show me your favorite health and fitness app.

**Follow-Up:** If you have more than one health and fitness app, show me the one you use the most now, and we will discuss the other apps later.

**Probe:** Tell me about what makes this one is your favorite.

**Probe:** Tell me about how you feel when you use this app.



**Probe:** Tell me about any special meaning this app has for you.

3. **Main Question:** Tell me about the behavior that you were trying to change or improve upon when you downloaded this app.

**Follow-Up:** Tell me about your history with [behavior].

**Probe:** Have you tried to [behavior] before?

**Probe:** Tell me about what you did before you got the app.

**Probe:** Tell me about how you have kept track your [behavior] before you had the app.

**Cue:** By keeping track of your [behavior] I mean tell me about how you may have logged or kept a record of your [behavior] in the past

**Follow-Up:** Tell me about your successes with [behavior] before you got the app.

**Probe:** Tell me about what you think may have helped you succeed.

**Probe:** Tell me about how those successes made you feel.

**Probe:** Tell me about how others have felt about your successes with [behavior]

**Cue:** By how they made you feel I mean tell me about what it meant to you to have that success at [behavior].

**Follow-Up:** Tell me about your setbacks with [behavior] before you got the app.

**Probe:** Tell me what you think may have caused those setbacks.

**Probe:** Tell me about how those setbacks made you feel.

**Probe:** Tell me about how others have felt about your setbacks with [behavior].

4. **Main Question:** Tell me what made you decide to try using a health and fitness app.

**Follow-Up:** Tell me about how you found out about the app.

**Probe:** How long have you had the app?

**Follow-Up:** Where did you first see/hear about the app?

**Probe:** Tell me about what you think made this app stand out to you.

**Probe:** What features of this particular app made you like it?

**Follow-Up:** Who was it that recommended the app to you?

**Probe:** Tell me why you think [person] recommended the app to you.

**Probe:** Was [person] using the app?

**Probe:** How did it feel to see [person] being successful using the app?

**Probe:** Tell me about how [person] felt about you using the app.

**Follow-Up:** What was it that made you go ahead and get it instead of another?

**Probe:** What do you know about this app that makes it different from other health and fitness apps?

5. **Main Question:** Tell me a little about how long you have been using the app?

**Follow-Up:** How long ago did you get the app?

6. **Main Question:** What did you hope to achieve when you got the app?

**Follow-Up:** What short-term goals did you have for yourself when you got the app?

**Cue:** When I say short-term goals I mean what you planned to achieve right away by using the app.

**Probe:** Tell me about who you shared your goal with.

**Probe:** Tell me about how it felt to share your goal with someone else.

**Probe:** Tell me about how [person] reacted to your goal.

**Follow-Up:** Tell me about the long terms goals you have for [behavior].

**Cue:** When I say long-term goals, I mean what you planned to achieve by using the app for an extended period of time.

**Follow-Up:** Did you reach [do you think that you will reach] your goals?

**Probe:** Tell me about how you feel about reaching (or not reaching) your goals?

**Follow-Up:** What do you think it was about the app that helped you reach your goals?

**Follow-Up:** Tell me about how you rewarded [will reward] yourself when you reach your goals?

**Probe:** Tell me about why this reward is import to you.

**Probe:** Tell me about how you felt when you gave yourself [reward].

7. **Main Question:** Tell me about how you think the app has changed your behavior?

**Probe:** Tell me about how this change in behavior made you feel?

**Follow-Up:** Tell me about how you think the app has changed your daily routine?

**Probe:** Tell me about how this change in routine makes you feel?

**Follow-Up:** How often in a normal [day, week, month] do you use/check your app?

8. **Main Question:** I want you to think about when you first got the app. Tell me about how often you used the app when you first got it.

**Follow-Up:** Now tell me about how often you use the app now.

**Probe:** Tell me about why you think your use of the app has [hasn't] changed over time.

**Probe:** Tell me about how this makes you feel.

**Follow-Up:** Tell me about how your feelings about using the app have changed over time.

**Probe:** Do you like the app [more/less] now than you did when you first downloaded it?

**Probe:** What is it about the app that makes you like it [more/less] [now/then]?

**Follow-Up:** Tell me about how your friends/family feels about your app.

**Probe:** Tell me about how you feel about their opinions about your app.

9. **Main Question:** Let's talk about the features of this app that are your favorites?

**Follow-Up:** Tell me which feature is your favorite?

**Probe:** Now tell me about which is your second favorite?

**Probe:** Now tell me about which is your third favorite?

**Probe:** What do you know about these features and how they work to help you [behavior]?

**Follow-Up:** Tell me about what you might change about these features to make them better.

**Follow-Up:** Are the features that made you want to try this app the same ones that you ranked as your favorite?

**Follow-Up:** What do you know about the features of this app that make it different from other similar apps?

10. **Main Question:** What particular features of this app are your least favorite?

**Follow-Up:** Which feature(s) do you like the least?

**Probe:** Tell me about why you don't like it.

**Probe:** What do you know about these features and how they work to help you [behavior]?

**Follow-Up:** Tell me about what you might change about these features to make them better.

**Follow-up:** What could the app have done to keep your interest longer?

**Follow-Up:** Are the features that made you want to try it this app the same ones that you said was your least favorite?

**Follow-Up:** What do you know about these features of this app that make it different from other similar apps?

11. **Main Question:** Tell me a little about what things in your day make it harder for you to use the app.

**Follow-Up:** Take me through a typical day when you are not able to or choose not to use your app.

**Probe:** How does it feel when [barrier] keeps you from using your app?

12. **Main Question:** What advice might you give to other young adults that want to use a health and fitness app to change their behavior?
13. **Main Question:** What are some of the health [risks/benefits] of [behavior]?
14. **Main Question:** What are some ways besides using a health and fitness app that people can [behavior]?
15. **Main Question:** What advice might you give to people like me that might want to develop or use health and fitness apps to help people similar to you be healthier?
16. **Main Question:** What question or questions should I have asked you today that I didn't ask you?

# Are you currently using a health and fitness app?

**If so we want to hear from you!**

**This study (IRB#\_\_\_\_) is collecting confidential information from young adults who use health and fitness apps. Participants will fill out a brief questionnaire and participate in a confidential one-on-one interview.**



**You are eligible to participate if you are:**

18-29 years old

Currently using a health and fitness app

Not enrolled in or graduated from college

***The University of Oklahoma is an equal opportunity institution.***

**You will receive a store gift card to compensate you for your time.**

**Your name will not be associated with any study results.**

**For more information, call or text 550-3643 or email [healthfitnessstudy@gmail.com](mailto:healthfitnessstudy@gmail.com)**

**Health & Fitness App**  
**Interview 550-3643**

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Interview 550-3643

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**Health & Fitness App  
Interview 550-3643**

## Appendix F: Study 1 Online Recruitment Posting

reply Posted: less than a minute ago

[print](#)

### ★ Do you use a Health and Fitness App? If so we want to hear from you! (Oklahoma)

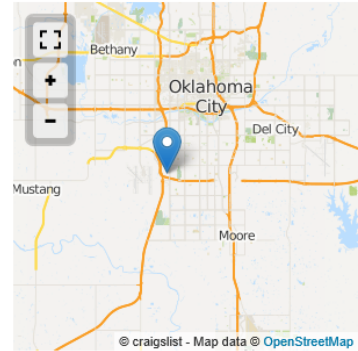


This study (IRB#\_\_\_\_\_) is collecting confidential information from young adults who use health and fitness apps. Participants will fill out a brief questionnaire and participate in a confidential one-on-on interview. You will receive a store gift card to compensate you for your time. Your name will not be associated with any study results.

You are eligible to participate if you are:  
18-29 years old  
Currently using a health and fitness app  
Not enrolled in or graduated from college

The University of Oklahoma is an equal opportunity institution

- do NOT contact me with unsolicited services or offers



[\(google map\)](#)

## Appendix G: Study 1 Demographic Questionnaire

What is your gender? \_\_\_\_\_

What is your age? \_\_\_\_\_

What is your race/ethnicity? \_\_\_\_\_

What is the highest level of school you have completed?

- ☐ Some High School
- ☐ High School Diploma or GED
- ☐ Technical School
- ☐ Some College

Where? \_\_\_\_\_

☐ College Graduate

Where? \_\_\_\_\_

Which of the following best describes your current living arrangement?

- ☐ Living with parents full-time
- ☐ Living with parents part-time or seasonally
- ☐ Living with another relative full-time
- ☐ Living with another relative part-time or seasonally
- ☐ Living alone or with a partner, spouse, or significant other
- ☐ Living with roommates or friends
- ☐ Other \_\_\_\_\_

What is your current employment status?

- ☐ Employed Full-Time
- ☐ Employed Part-Time
- ☐ Employed Temporary
- ☐ Employed Seasonal
- ☐ Not Currently Employed
- ☐ Other \_\_\_\_\_

If you are employed which of the following best describes the type of organization you work for?

- ☐ Retail
- ☐ Service
- ☐ Construction /Manufacturing
- ☐ Government / Non-Profit
- ☐ Wholesale
- ☐ Other \_\_\_\_\_

At the end of the month which of the following best describes your situation?

- ☐ I have money left over
- ☐ I have just enough money to get by
- ☐ I still have bills to pay

What type of phone do you currently use?

- ☐ Apple iPhone
- ☐ Microsoft
- ☐ Motorola
- ☐ Samsung
- ☐ HTC
- ☐ Nokia
- ☐ LG
- ☐ Sony
- ☐ Other \_\_\_\_\_

Which of the following types of apps do you currently have on your phone? (Choose all that apply)

- ☐ Games
- ☐ Social Networking
- ☐ News
- ☐ Sports
- ☐ Health & Fitness
- ☐ Medical
- ☐ Entertainment
- ☐ Other \_\_\_\_\_

Of your 3 best friends how many have a health and fitness app? \_\_\_\_\_

Of your 3 best friends how many have a wearable activity tracker? \_\_\_\_\_

During a normal week how many days of the week do you engage in physical activity? \_\_\_\_\_

During a normal week how many days of the week do you eat healthy? \_\_\_\_\_

Has a doctor ever told you that you have any of the following health conditions:

- |                     |                              |                             |
|---------------------|------------------------------|-----------------------------|
| High Cholesterol    | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| Diabetes            | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| High Blood Pressure | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| Joint Problems      | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| Sleep Apnea         | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| Asthma              | <input type="checkbox"/> yes | <input type="checkbox"/> no |

**Appendix H: Study 2 Social Cognitive Theory Constructs, Definitions, and Example Questions**

<b>Construct</b>	<b>Definition</b>	<b>Example Questions</b>
Knowledge	Awareness of health risks and benefits of different health practices	<p>What are some of the health [risks/benefits] of [behavior]?</p> <p>What are some ways besides using a wearable activity tracker that people can [behavior]?</p>
Perceived Self-Efficacy	Beliefs about personal ability to control one's health habits	<p>Tell me about your successes with [behavior] before you got the wearable activity tracker.</p> <p>Tell me about how those successes made you feel.</p>
Outcome Expectations	The expected costs and benefits for different health habits	<p>Tell me what made you decide to try using a wearable activity tracker.</p> <p>What did you hope to achieve when you got the wearable activity tracker?</p>
Goals	The health goals that people set for themselves and the concrete plans and strategies for helping meet them	<p>What short-term goals did you have for yourself when you got the wearable activity tracker?</p> <p>Tell me about who you shared your goal with?</p>
Perceived Facilitators and Impediments	Social and structural issues that can aid or hinder the behavior change	<p>What might happen during your day that would keep you from using your wearable activity tracker?</p> <p>Tell me about what you think may have helped you succeed [with behavior].</p>



## Appendix I: Study 2 Type of Questions, Purpose of Questions, and Example Questions

Type of Question	Purpose	Example Questions
Experience Behavior Questions	Intended to elicit descriptions of experiences, behaviors, actions, activities; what a person has done, seen, heard, or thought.	<p><b>Main Question:</b> So tell me about the behavior that you were trying to change or improve upon when you got your wearable activity tracker.</p> <p><b>Follow-Up:</b> Tell me about your history with this behavior.</p> <p><b>Probe:</b> Have you tried to [behavior] before?</p>
Knowledge Questions*	Intended to discover what people consider factual information. Interviewer records, but does not correct misinformation, except at the end of the interview.	<p><b>Follow-Up:</b> What do you know about this app that makes it different from other wearable activity trackers?</p> <p><b>Follow-Up:</b> What do you know about the features of this app that make it different from other similar other wearable activity trackers?</p>
Opinion/Value Questions	Aimed at how people interpret specific events or issues; answers reflect a decision-making process and may reveal goals, opinions, norms, intentions, desires, and values.	<p><b>Main Question:</b> What did you hope to achieve when you got the wearable activity tracker?</p> <p><b>Follow-Up:</b> What short-term goals did you have for yourself when you got the wearable activity tracker?</p> <p><b>Probe:</b> Tell me about who you shared your goal with.</p>
Feeling Questions*	Probes emotional responses to experiences. Typically spontaneous, often not the result of a decision, often non-rational. May emerge in responses to other kinds of questions	<p><b>Follow-Up:</b> Tell me about your successes with [behavior] before you got the wearable activity tracker.</p> <p><b>Probe:</b> Tell me about how those successes made you feel.</p> <p><b>Follow-Up:</b> Tell me about your setbacks with [behavior] before you got the wearable activity tracker.</p> <p><b>Probe:</b> Tell me a little about how those setbacks made you feel.</p>

## Appendix J: Study 2 Main Questions Linked to Research Questions

Main Question (Follow-Ups and Probes Not Listed)	Research Question
Ok, what I would like you to do is show me your activity tracker.	RQ1 / RQ2
Ok, now I would like you to show me the app that comes along with your activity tracker.	RQ1
Tell me about the behavior that you were trying to change or improve upon when you got the activity tracker.	RQ1 / RQ3
Tell me what made you decide to try using an activity tracker	RQ1 / RQ2
Tell me a little about how long you have been using the tracker?	RQ1 / RQ3
What did you hope to achieve when you got the tracker?	RQ1 / RQ3
Tell me about how you think the tracker and/or the app has changed your behavior?	RQ3
I want you to think about when you first got your tracker. Tell me about how often you wore the tracker when you first go it.	RQ1 / RQ3
Tell me about why you think your use of the tracker has [hasn't] changed over time	RQ1 / RQ3
Tell me about how your feelings about using the tracker have changed over time.	RQ1 / RQ2
Let's talk about the features of this tracker and/or the app that are your favorites?	RQ1
What particular features of this tracker and/or the app are your least favorite?	RQ1
Tell me a little about what makes it harder for you to use your tracker.	RQ1
What advice might you give to other young adults that want to use activity trackers to change their behavior?	RQ3
What are some ways besides using an activity tracker that people can [behavior]?	RQ3
What are some of the health [risks/benefits] of [behavior]?	RQ3
What do you think that other people your age are doing to change or maintain [behavior]?	RQ3

## Appendix K: Study 2 Interview Question Path

### Introduction

Thank you for agreeing to take part in this discussion about wearable activity trackers.

My name is \_\_\_\_\_ and I work with the University of Oklahoma. With me today is \_\_\_\_\_, who will be assisting me during the session.

We are interested in learning more about the wearable activity trackers that young adults like you use and why they use them. We've asked you to participate today because you have told us that you use one of the health and fitness apps that we are interested in learning more about.

We're here today to learn from you. There are no right or wrong answers. We want to hear your point of view. We are here today to ask questions and to listen to you. We would like to record the discussion today because it is impossible to listen to you and take notes and we want to make sure that we don't miss anything you say. This discussion is confidential and no names will be used in our report. Is that ok?

At this time I'd like to ask that you keep your phone out so that we can refer to it, but I would also like to ask you not to check your emails or text messages or answer any phone calls during our discussion.

*\*\*Note: For many questions a list of possible probes are provided. These will be utilized based upon the participant's responses \*\**

### Interview Questions

1. **Main Question:** Ok, what I would like you to do is show me your activity tracker.

**Follow-Up:** How long have you had the activity tracker?

**Follow-Up:** Tell me everything you know about your activity tracker.

**Probe:** What features does it have available for you to use?

**Probe:** Tell me about how you feel when you use your activity tracker.

**Probe:** Tell me about any special meaning this activity tracker has for you.

**Follow-Up:** If someone you like saw you using your activity tracker what do you think they would think of it?

**Probe:** What might they think about you for having it?

2. **Main Question:** Ok, now I would like you to show me the app that comes along with your activity tracker.

**Follow-Up:** Tell me about the app.

**Probe:** What features does it have for you to use?

**Probe:** Tell me about which features you use the most.

3. **Main Question:** Tell me about the behavior that you were trying to change or improve upon when you got the activity tracker.

**Follow-Up:** Tell me about your history with [behavior].

**Follow-Up:** Have you tried to [behavior] before?

**Probe:** Tell me about what you did before you got the activity tracker.

**Probe:** Tell me about how you monitored your [behavior] before you had the activity tracker.

**Cue:** By monitoring I mean tell me about how you [behavior] in the past

**Probe:** Tell me about your successes before you got the activity tracker.

**Probe:** Tell me about how those successes made you feel.

**Probe:** Tell me about what you think others thought about your successes with [behavior]

**Cue:** By how they made you feel I mean tell me about what it meant to you to have that success at [behavior].

**Probe:** Tell me about your failures before you got the activity tracker.

**Probe:** Tell me about how those failures made you feel.

**Probe:** Tell me about what you think others thought about your failures with [behavior]

4. **Main Question:** Tell me what made you decide to try using an activity tracker.

**Follow-Up:** Tell me about how you found out about the activity tracker.

**Follow-Up:** Where did you first see/hear about the activity tracker?

**Probe:** Tell me about what you think made this particular tracker stand out to you.

**Probe:** What features of this particular tracker and its app made you like it?

**Follow-Up:** Who was it that recommended the tracker to you?

**Probe:** Tell me why you think [person] recommended this tracker to you.

**Probe:** Was [person] using this tracker?

**Probe:** How did it feel to see [person] being successful using this tracker?

**Probe:** Tell me about how [person] felt about you using the activity tracker.

**Follow-Up:** There are a lot of trackers out there what was it that made you go ahead and get this one instead of another?

**Probe:** What do you know about this tracker that makes it different from all the other ones?

5. **Main Question:** Tell me a little about how long you have been using the tracker?

**Follow-Up:** How long ago did you get the tracker?

6. **Main Question:** What did you hope to achieve when you got the tracker?

**Follow-Up:** What short-term goals did you have for yourself when you got the tracker?

**Cue:** When I say short-term goals I mean what you planned to achieve right away by using the tracker.

**Probe:** Tell me about who you shared your goal with?

**Probe:** Tell me about how it felt to share your goal with someone else.

**Probe:** Tell me about how [person] reacted to your goal.

**Follow-Up:** Tell me about the long terms goals you have for [behavior].

**Cue:** When I say long-term goals, I mean what you planned to achieve by using the tracker for an extended period of time.

**Follow-Up:** Did you reach [do you think that you will reach] your goals?

**Probe:** Tell me about how you feel about reaching (or not reaching) your goals?

**Follow-Up:** What do you think it was about the tracker and/or the app that helped you reach your goals?

**Follow-Up:** Tell me about how you rewarded [will reward] yourself when you reach your goals?

**Probe:** Tell me about why this reward is import to you.

**Probe:** Tell me about how you felt when you gave yourself [reward].

7. **Main Question:** Tell me about how you think the tracker and/or the app has changed your behavior?

**Follow-Up:** Tell me about how you think the tracker has changed your daily routine?

**Probe:** Tell me about how this change in routine makes you feel?

**Probe:** Tell me about how this change in behavior made you feel?

**Follow-Up:** How often in a normal [day, week, month] do you wear your tracker?

**Probe:** How often in a normal [day, week, month] do you check your data on the app that came with your tracker?

8. **Main Question:** I want you to think about when you first got your tracker. Tell me about how often you wore the tracker when you first go it.

**Follow-Up:** Now tell me about how often you wear the tracker now.

**Follow-Up:** What about the app, when you first got the tracker, how often did you check the app?

**Probe:** What about now, how often do you check the app now?

**Follow-Up:** Tell me about how your friends/family feel about your activity tracker.

**Probe:** Tell me about how their opinions about your activity tracker make you feel.

9. **Main Question:** Tell me about why you think your use of the tracker has [hasn't] changed over time.

**Follow-Up:** Tell me about how this makes you feel.

**Follow-Up:** Tell me about why you think your use of the app has [hasn't] changed over time.

**Probe:** Tell me about how this makes you feel.

10. **Main Question:** Tell me about how your feelings about using the tracker have changed over time.

**Follow-Up:** Do you like the tracker [more/less] now than you did when you first got it?

**Probe:** What is it about the tracker that makes you like it [more/less] [now/then]?

**Follow-Up:** What about the app, do you like the app [more/less] now than you did when you first got it?

**Probe:** What is it about the app that makes you like it [more/less] [now/then]?

11. **Main Question:** Let's talk about the features of this tracker and/or the app that are your favorites?

**Follow-Up:** Tell me which feature is your favorite?

**Probe:** Now tell me about which is your second favorite?

**Probe:** Now tell me about which is your third favorite?

**Probe:** What do you know about these features and how they work to help you [behavior]?

**Follow-Up:** Tell me about what you might change about these features to make them better.

**Follow-Up:** Are the features that made you want to try this tracker and/or the app the same ones that you ranked as your favorite?

**Follow-Up:** What do you know about the features of this tracker and/or the app that make it different from other similar apps?

12. **Main Question:** What particular features of this tracker and/or the app are your least favorite?

**Follow-Up:** Which feature do you dislike the most?

**Probe:** Tell me about why you dislike it.

**Probe:** What do you know about these features and how they work to help you [behavior]?

**Follow-Up:** Tell me about what you might change about these features to make them better.

**Follow-up:** What could the tracker and/or the app have done to keep your interest longer?

**Follow-Up:** Are the features that made you want to try it this tracker the same ones that you said were your least favorite?

**Follow-Up:** What do you know about these features of this tracker that make it different from other similar apps?

13. **Main Question:** Tell me a little about what makes it harder for you to use your tracker.

**Follow-Up:** What might happen during your day that would keep you from using your tracker?

**Probe:** How does it feel when [barrier] keeps you from using your tracker?

**Follow-Up:** How often would you say that you wear the tracker, but then don't use the app to check your data?

**Probe:** What might happen during your day that would keep you from using the app?

**Probe:** How does it feel when [barrier] keeps you from using your app?

14. **Main Question:** What advice might you give to other young adults that want to use activity trackers to change their behavior?
15. **Main Question:** What are some ways besides using an activity tracker that people can [behavior]?
16. **Main Question:** What are some of the health [risks/benefits] of [behavior]?
17. **Main Question:** What do you think that other people your age are doing to change or maintain [behavior]?
18. **Main Question:** What advice might you give to people like me that might want to use activity trackers to help people similar to you be healthier?
19. **Main Question:** What question or questions should I have asked you today that I didn't ask you?



# Are you currently using an wearable activity tracker?

**If so we want to hear from you!**

This study (IRB#\_\_\_\_) is collecting confidential information from young adults who use activity trackers. Participants will fill out a brief questionnaire and participate in a confidential one-on-one interview.



**You are eligible to participate if you are:**

18-25 years old

Currently using a wearable activity tracker

Enrolled in college

*The University of Oklahoma is an equal opportunity institution.*

**You will receive a store gift card to compensate you for your time.**

**Your name will not be associated with any study results.**

**For more information, call or text 550-3643 or email [healthfitnessstudy@gmail.com](mailto:healthfitnessstudy@gmail.com)**

Health & Fitness App  
Interview 550-3643

Health & Fitness App  
Interview 550-3643

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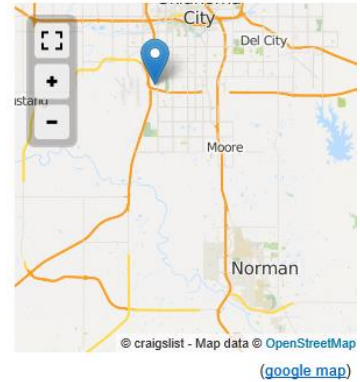
Health & Fitness App  
Interview 550-3643

Health & Fitness App  
Interview 550-3643

Health & Fitness App  
Interview 550-3643

## Appendix M: Study 2 Online Recruitment Posting

### ★ Do you use a Wearable Activity Tracker? If so we want to hear from you (Oklahoma)



This study (IRB#\_\_\_\_\_) is collecting confidential information from young adults who use activity trackers. Participants will fill out a brief questionnaire and participate in a confidential one-on-one interview. You will receive a store gift card to compensate you for your time. Your name will not be associated with any study results.

You are eligible to participate if you are:  
18-25 years old  
Currently using a wearable activity tracker  
Enrolled in college

The University of Oklahoma is an equal opportunity institution

- do NOT contact me with unsolicited services or offers

## Appendix N: Study 2 Demographic Questionnaire

What is your gender? \_\_\_\_\_

What is your age? \_\_\_\_\_

What is your race/ethnicity? \_\_\_\_\_

What year of college are you currently in?

☐ 1<sup>st</sup> year

☐ 2<sup>nd</sup> year

☐ 3<sup>rd</sup> year

☐ 4<sup>th</sup> year

☐ 5<sup>th</sup> year

☐ Graduate Student

☐ Other \_\_\_\_\_

Which of the following best describes your current living arrangement?

☐ Living with parents full-time

☐ Living with parents part-time or seasonally

☐ Living with another relative full-time

☐ Living with another relative part-time or seasonally

☐ Living alone or with a partner, spouse, or significant other

☐ Living with roommates or friends

☐ Living in other student housing

☐ Other \_\_\_\_\_

What is your current employment status?

☐ Employed Full-Time

☐ Employed Part-Time

☐ Employed Temporary

☐ Employed Seasonal

☐ Not Currently Employed

☐ Other \_\_\_\_\_

If you are employed which of the following best describes the type of organization you work for?

☐ Retail

☐ Service

☐ Construction /Manufacturing

☐ Government / Non-Profit

☐ Wholesale

☐ Other \_\_\_\_\_

At the end of the month which of the following best describes your situation?

☐ I have money left over

☐ I have just enough money to get by

☐ I still have bills to pay

What type of phone do you currently use?

☐ Apple iPhone

☐ Microsoft

☐ Motorola

☐ Samsung

☐ HTC

☐ Nokia

☐ LG

☐ Sony

☐ Other \_\_\_\_\_

Which of the following types of apps do you currently have on your phone? (Choose all that apply)

☐ Games

☐ Social Networking

☐ News

☐ Sports

☐ Health & Fitness

☐ Medical

☐ Entertainment

☐ Other \_\_\_\_\_

Which of the following types of activity trackers do you currently own?

☐ FitBit

☐ Apple Watch

☐ Jawbone

☐ Garmin

☐ MisFit

☐ Withings

☐ Other \_\_\_\_\_

Of your 3 best friends how many have a wearable activity tracker? \_\_\_\_\_

During a normal week how many days of the week do you engage in physical activity? \_\_\_\_\_

During a normal week how many days of the week do you eat healthy? \_\_\_\_\_

Has a doctor ever told you that you have any of the following health conditions:

High Cholesterol ☐ yes ☐ no

Diabetes ☐ yes ☐ no

High Blood Pressure ☐ yes ☐ no

Joint Problems ☐ yes ☐ no

Sleep Apnea ☐ yes ☐ no

Asthma ☐ yes ☐ no