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# Young Female College Millennials' Intent for Behavior Change with Wearable Fitness Technology

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Walden University
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Abstract

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MA, Kaplan University, 2014

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Dissertation Submitted in Partial Fulfillment

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Abstract

Among young college-aged females, overweight and obesity, type 2 diabetes, uncontrolled hypertension, and high stress levels have increased, causing overall worse health conditions than previous generations. The use of wearable fitness technology (WFT) by young adults assists in fitness and nutrition monitoring, provides feedback in health statistics, and has shown improvements in reducing health-related issues in young college females. A wide body of literature related to physical activity, nutrition, and health issues in young college females exists; however, the experiences and intent of WFT use for behavior change by young college female millennials has not been well researched. The purpose of this phenomenological study was to examine the lived experiences of young college females' intent for behavior change with WFT. The health belief model was the theoretical framework used for this study. Ten college females, 18-25 years of age, attending colleges in northern West Virginia, who were collecting data from a WFT for a minimum of six months completed individual face-to-face interviews. Data were analyzed using phenomenological thematic analysis. Results from the study revealed young college females use WFT to increase physical activity, identify calorie intake and energy expenditure, and monitor heart rate, sleep, and stress to decrease and prevent health issues. These results can provide evidence for other researchers to address the current health inequalities in young college adults. Positive social change implications could include the value of WFT regarding the growing evidence of the importance of physical activity and nutrition by young female college students related to positive health outcomes and reducing health issues in this specific population.

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Dedication

I would like to dedicate this dissertation to my family who have continually encouraged me when I thought I could no longer continue this long journey. Also, I would like to dedicate this work to my closest friends and my children who motivated me during this process and understood how important this study was for me.

I would also like to dedicate this work to all young college females who struggle with health issues. Additionally, I would like to dedicate this dissertation to the millennial generation and to all future generations who excel in the need for the use of technology related to their health.

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# Chapter 1: Introduction to the Study

## Introduction

Young adults are struggling to maintain healthy lifestyles, as risky behaviors such as fast food consumption, physical inactivity, and stress have created a generation with a high incidence of obesity (Nanney et al., 2015). Additionally, increased hypertension, uncontrolled glucose levels, and adverse changes in blood lipids currently suggest poor health outcomes for young adults (Johnson, Warner, LaMantia, & Bowers, 2016). Historically, health issues have affected middle-aged or older-aged adults; however, the evidence of increased health disparities among young adults is a social issue concern (Poobalan, & Aucott, 2016).

Several studies indicate that young adults, ages 18-25, have the highest rate of increased weight gain than any other age group (Bertz, Pacanowski, & Levitisky, 2015; Poobalan & Aucott, 2016; Valle et al., 2015). As each birth cohort has a higher prevalence of overweight and obesity than prior age groups, the current generation will experience obesity over a greater percentage of their lifetime (Casagrande, Menke, & Cowie, 2016). In addition, hypertension affects approximately one in five young adult males, and one in six young adult females, creating generational health risks for cardiovascular disease (Johnson et al., 2016). A rapid rise in type 2 diabetes presents greater physical morbidity and mortality for this young population (Browne, Nefs, Pouwer, & Speight, 2015; Casagrande et al., 2016). Similarly, one in five young adults have abnormal cholesterol and have a low-density lipoprotein cholesterol level that would require pharmacologic treatment (Gooding et al., 2016).

Health behaviors throughout the young adult developmental stage are important, as they are likely to become habits that continue into late adulthood (Wing et al., 2015). Often, young adults, particularly those born in recent decades, face challenges of an obesogenic environment imbued with inexpensive, poor nutritional-quality processed foods, and sedentary lifestyles (Hebden, Chan, Louie, Rangan, & Allman-Farinelli, 2015). Adverse health consequences of risky health behaviors by young adults suggest the need for both research studies and age-related health prevention strategies. Nikolaou, Hankey, and Lean (2015) suggested targeting young adults who are particularly susceptible to obesity and chronic disease, as they may be more receptive to health-related information.

A vital component for prevention strategies to reduce health inequalities in young adults, and help them maintain a healthy weight, is physical activity engagement (World Health Organization, 2016). Recommendations of physical activity for weight maintenance in young adults is 150 minutes of moderate-intense activity or 75 minutes of dynamic-intense activity per week (Valle et al., 2015). Several studies have indicated that weight gain can occur during young adulthood (Cha et al., 2015; Gowin, Cheney, Gwin, & Franklin Wann, 2015; Hebden et al., 2015); therefore, reaching the goal for recommended physical activity could reduce overall prevalence of overweight and obesity, cardiovascular disease, type 2 diabetes, and high cholesterol (Bertz et al., 2015).

One population affected by declining physical activity is traditional students attending tertiary colleges and universities that are a part of the generation termed *millennials*, which typically describes a group of young adults born during most of the

1980s and 1990s (Nelson et al., 2016). Abraham and Harrington (2015) referred to the millennial generation as those born between 1982 and 2000; however, for this study, the focus was on college-age millennials, 18-25 years of age. Despite the importance of physical activity, many young adults attending college fall short of the physical activity guidelines (Rennis, Mcnamara, Seidel, & Shneyderman, 2015). On average, 40-50% of college students are physically inactive and do not achieve recommended levels of physical activity (Deliens, Deforche, De Bourdeaudhuij, & Clarys, 2015).

Colleges and universities provide support for establishing healthy behaviors for students by resources such as nutrition and access to health and fitness facilities (Plotnikoff et al., 2015); however, time constraints, laziness, additional priorities, budget, and lack of motivation are common barriers for not participating in physical activity (Pei-Tzu, Wen-Lan, & I-Hua, 2015). Contrary to barriers, motivators for physical activity among this population are pleasure, health, (Pei-Tzu et al., 2015), positive outcome expectations (Elkins, Nabors, King, & Vidourek, 2015), and a strong generational characteristic of social interaction (Vaterlaus, Patten, Roche, & Young, 2015).

Of young college adults, female students participate in less physical activity than male students (Xiangli, Tao, & Smith, 2015; Gu, Zhang, & Smith, 2015). Additionally, more female college students report no days of moderate-intensity or vigorous-intensity aerobic exercise of the recommended 20 to 30 minutes per week (Milroy, Orsini, D'abundo, Sidman, & Venzia, 2015). Unlike male college students who are motivated by factors including challenge, competition, status, and strength, female college students are motivated by distinct factors such as managing healthy weight, body image, guilt, and health (Molanorouzi, Khoo, & Morris, 2015). One study conducted on physical activity in female college students suggests that regular exercise helps prevent health disparities, maintains physical functions and body shape, and improves mental well-being (Gu et al., 2015).

On average, young adults 18-25 years of age, spend 11-12 hours of their day facilitating social interaction, using some form of technology, and less time performing the recommended physical activity, which could potentially reduce health inequalities (Vaterlaus et al., 2015). Wearable fitness technology (WFT), a new state-of-the-art computer worn on the body, tracks and monitors data during daily activity and physical activity, syncs to a smartphone for long-term tracking, employs social interaction, and has become extremely popular among young adults (Kaewkannate & Kim, 2016). Additionally, WFT monitors physical activity and displays data for the user to receive instant feedback (Kaewkannate & Kim, 2016), a form of intellectual fulfillment that millennials seek. Thus, the association with the use of WFT to engage young adults in health-related interventions has been identified as a significant area of upcoming research (Lytle et al., 2016). For example, Vaterlaus et al. (2015) conducted a study on the perceived influence of WFT use on the health behaviors of young adults, finding that using WFT during physical activity can be either a motivator or a barrier. Young adults are motivated to use WFT based on perceived usefulness related to positive data performance, behavioral attitudes, and physical activity intentions (Lunney, Cunningham, & Eastin, 2016).

However, a barrier to the adoption of WFT by young adults is the inability of the device to meet the expected technically-advanced needs of this achievement-oriented population (Stephens, Moscou-Jackson, & Allen, 2015). An additional barrier is that some WFT lacks the capabilities of syncing quantified data to other smart devices (Gilmore, 2015). A critical component of WFT for young female college students is the ability to sync collected data to social networking applications, such as Facebook or Twitter, to share physical activity accomplishments with their friends (Middelweerd et al., 2015). Additionally, young adults are tech-savvy, have high social media skills, experience daily integrated technology interaction, and are a technologically-wired generation (Lytle et al., 2016); therefore, use of WFT for behavioral and physiological feedback must meet generational consumer expectations (Piwek, Ellis, Andrews, & Joinson, 2016).

Advanced technologies such as WFT allow young adults to interact with multiple smart devices simultaneously (Zhang & Rau, 2015), and provide technical capabilities essential for social interaction and instant gratification (Kreitzberg, Dailey, Vogt, Robinson, & Zhu, 2016. The millennial college-age population differs in characteristics from other generations, as they see traditional health and fitness facilities as outdated (Lathan, 2016). Thus, adding WFT while performing physical activity provides opportunity to collect fitness data in real-time, generate eagerness and adherence, and meet the quantifiable technologic and social networking needs for young college females (West et al., 2016).

Female and male college students differ on their needs and uses of WTF. For example, Zhang and Rau (2015) explored the influence of display, motion, and gender with multiple WFT use in young college adults and concluded that female college students are more process-oriented and experience entertainment, flow, and data gratification with use of WFT, whereas male college students are more task-oriented and interested in product utility. More specifically, female college students outperformed male college students in some multitasking paradigms; therefore, usage patterns of WFT differed between female and male young adults (Zhang & Rau, 2015).

Despite the significance of physical activity, numerous challenges and characteristics prevent young adult female college students from engaging in the recommended amount of physical activity. WFT may provide a novel prevention strategy to increase the amount of physical activity performed each day by this specific population (Rupp, Michaelis, McConnell, & Smither, 2016). Little information is available on the experiences related to the intended use of WFT in young females attending tertiary education. Understanding the relationship between young female college students and their use of WFT can provide data for further prevention strategy design, targeting reduction of health disparities in this specific population.

In Chapter 1, the need for the study, the research questions and the purpose of the study are specified. The research methodology and theoretical concepts, and the nature of the study are also addressed. The first chapter includes definitions, assumptions, scope and delimitations, and limitations. Chapter 1 ends with the significance of the study, a summary of the main points, and the transition to Chapter 2.

## Background of the Study

Previous researchers have identified a current increase in health inequalities in young adults, such as being overweight and being obese, hypertension, type 2 diabetes, and high cholesterol (Cha et al., 2015; Florêncio et al., 2016; Johnson et al., 2016; Karp & Gesell, 2015). As shown in several studies, college students are entering an autonomous, independent, accountable age, with a self-focus on health; however, they feel stressed and overwhelmed and may lack self-assurance to successfully manage healthy behaviors (Much, Wagener, Breitkreutz, & Hellenbrand, 2014; Reifman, Arnett, & Colwell, 2016). Therefore, young adult age 18-25 entering tertiary education are at a significant period for health-related strategies to prevent later adulthood health disparities (Jakicic et al., 2016).

Typically, physical inactivity, fast food consumption, stress (Deliens et al., 2015; Nanney et al., 2015), poor nutritional intake (Plotnikoff et al., 2015), inadequate sleep, and overall poor health-related behaviors (Skalamera, & Hummer, 2016) are common factors related to health outcomes of young adults (Nanney et al., 2015). However, if young adults adopt a habitual physical activity engagement, risks of developing lifestyle related disparities could be reduced (Giles & Brennan, 2015). Young adults can benefit from physical activity and significantly decrease prevalence of future health issues (Kvintová, & Sigmund, 2016), mortality, and increase physical and mental stability (Molanorouzi et al., 2015).

Recently, innovative, and trendy WFT devices have made fitness monitoring easier for young college students (Lunney et al., 2016). Rupp et al. (2016) posited that

WFT can potentially increase daily recommended physical activity as a less onerous and familiar technologic data collection method, which could motivate this population to reach fitness goals. Digital communication devices, such as WFT, use sensors to measure and compile data, including steps taken, miles, calories burned, heart rate, sleep tracking (Rupp et al., 2016), and sync wirelessly to smartphones (Kaewkannate & Kim 2016). Additionally, smart data collection (Fotopoulou & O'Riordan, 2017), the inconspicuous tracking progress, and periodic reward gratification of goal expectations displayed on WFT stimulate young adults (Donnelly, 2016). Young college students possess an overt behavior of being connected to electronic data as a form of communicative social attentiveness (Vorderer, Kromer, & Schneider, 2016). Furthermore, college students thrive on graphic communication through technology and the instant satisfaction WFT provides (Chen, Teo, & Zhou, 2016).

Today, college students number more than 90 million (Much et al., 2014), are of the millennial generation, and are a highly diverse population (Ishii, Rife, & Kagawa, 2016). Characteristically, millennials who are contemporary college students were born and raised with the Internet and have a strong connection to technology devices (Schweitzer, Ross, Klein, Lei, & Mackey, 2016). As a result, the ability for millennials to multitask using smart devices, and the reception of pervasive computing, suggest a knowledgeable transition and adoption of WFT (Cheon, Jarrahi, & Su, 2016). As the wearable fitness market is estimated to top 5 billion dollars by 2019 (Butler and Luebbers,2016), and $40 billion in consumer sales by 2020 (Cheon et al., 2016), WFT is increasingly available to young adults (West et al., 2016), user-friendly, and affordable (Dontje, de Groot, Lengton, van der Schans, & Krijnen, 2015).

According to Price, Whitt-Glover, Kraus, and McKenzie (2016), 31% of female college students are overweight or obese, yet despite apprehensions about weight and body shape (Musaiger, Hammad, Tayyem, & Qatatsheh, 2015), this population participates less in physical activity than their male counterparts (Gu et al., 2015). One study found that there is interest by females with the use of WFT; however, the tool was not an effective stand-alone device for increasing physical activity in this population (Melton, Buman, Vogel, Harris, & Bigham, 2016). WFT provides motivational reminders and updates of physical activity goals that are important features for young college females (Santa Mina, 2017). Thus, WFT offers a familiar and appealing platform for health-related strategies targeting female college students (West et al., 2016). Canhoto and Arp (2016) explored motivation of intrinsic and extrinsic goals pursued by individuals' use of WFT and noted that adoption, continual use, portability, and ability to collect activity data are essential elements of the WFT related to healthy behavior change. Rupp et al. (2016) analyzed self-motivation and trust in the use of WFT by individuals and concluded both were predictive of continual use.

Technology-related strategies like WTF have been shown to have an equal if not added value compared to traditional prevention strategies. Investigations of the influence of WFT on physical activity and positive health outcomes concluded similar results to nontechnology health prevention strategies, suggesting that WFT can produce better adherence rates and effectively reduce body weight (Kreitzberg et al., 2016). De Vries, Kooiman, van Ittersum, van Brussel, and de Groot (2016) provided insight on increases in physical activity with the use of WFT, compared to interventions without, and concluded that WFT was an added value for enhancing self-awareness of recommended daily physical activity.

Previous researchers have concluded that WFT can increase physical activity engagement to encourage healthy lifestyle behaviors (Cadmus-Bertram, Marcus, Patterson, Parker, & Morey, 2015; Kreitzberg et al., 2016; Piwek et al., 2016), which can be beneficial to young female college adults. Although researchers have studied validity and reliability of WFT (Huang, Xu, Yu, & Shull, 2016; Kooiman et al., 2015; Rupp et al., 2016); convenience and usefulness (Weber, 2015); adherence, adoption, and necessary continual use (Cadmus-Bertram et al., 2015; Canhoto & Arp, 2016); comparison of efficiency of different WFT brands (Kaewkannate & Kim, 2016); and the use of WFT to motivate young adults to increase physical activity (Bice, Ball, & McClean, 2016), most research studies have been quantitative. Despite the amount of current quantitative research with the use of WFT, the experience of the user (Gilmore, 2015) and the insight on the use of WFT are qualitative characteristics that need to be studied (Rupp et al., 2016). Existing research conducted to date has shown positive results between WFT and physical activity (Melton et al., 2016); however, there is a gap in the literature on young female college students' lived experiences on the intent for behavior change with the use of WFT.

## Problem Statement

Young adults have increased rates of being overweight or being obese (Cha et al., 2015; Florêncio et al., 2016: Stephens et al., 2015). In addition, there is a rapid rise in type 2 diabetes (Amuta, Crosslin, Goodman, & Barry, 2016a) with young females more likely to have increased lifetime risk sensitivities for developing type 2 diabetes than young males (Amuta, Jacobs, Barry, Popoola, & Crosslin, 2016b). Uncontrolled hypertension (Johnson et al., 2016) and overall worse health than previous generations are also health concerns for young female college adults (Skalamera & Hummer, 2016). Gooding et al. (2016) indicated that young adults have abnormal cholesterol levels and low-density lipoprotein cholesterol levels that can lead to heart disease in later adulthood.

A contributing factor to being overweight and being obese is caloric-dense snacking and lack of physical activity (Deliens et al., 2015; Plotnikoff et al., 2015). Furthermore, research suggests that female college students snack more on unhealthy foods than male students during emotional stress (Downes, 2015). Many young adults have a fast food obsession, sedentary academic or professional careers, and make poor health-related choices (Watts, Laska, Larson, Niemark-Sztainer, 2016). Hence, unhealthy nutrition and exercise behaviors established during young adulthood may lead to risky health consequences (Vaterlaus et al., 2015), costly and debilitating health disparities, and premature chronic disease, morbidity, and mortality (Allman-Farinelli, 2015).

Because physical activity has many health benefits, the use of WTF can help prevent health risks in college students by motivating them to participate in more physical activity. Cox et al. (2016) reported that regular physical activity has numerous physical benefits and is associated with a decreased health risk of developing hypertension, type 2 diabetes, high cholesterol, and obesity. Ridker and Cook (2017) stated that physical activity and proper nutritional adherence are necessary behaviors for prevention of high cholesterol and cardiovascular disease in young adults. Physical activity plays a significant role in weight control and reducing health issues; however, despite the known benefits of physical activity and proper nutrition to reduce health concerns in young college adults, this population has low physical activity and high sedentary times (Unick et al., 2017). Laska et al. (2016) indicated that using innovative technologies such as WFT may be predominantly applicable to young college adults to increase physical activity, adhere to nutritional recommendations, and reduce health issues.

An increase in the use of WFT by young adults assists in fitness monitoring (Watts et al., 2016), provides instant feedback in weight-related statistics (Lunney et al., 2016), and when implemented in weight-related prevention programs, has shown improvements in reducing health-related issues (Jakicic et al., 2016). WFT, with its ability to provide quantifiable data, has gained enormous popularity among young female adults (Lunney et al., 2016). This technology provides quantification of the instantaneous data ideology and interpersonal communication perspectives associated with the Internet fixation by college-age millennials.

Characteristics of young adults include high technology literacy, quick assimilation to data, functional networking ability, graphic preference (Desy, Reed, &

Wolanskyj, 2017), and technology, including WFT, when seeking data related to their health. Tracking physical activity, measurement validity, and generating salient data is ultimately motivating to young adults (Rupp et al., 2016). Peer social influence, fitness inclusion, and social features of WFT contribute to the need for social-connectedness and social data communication of young adults (Kreitzberg et al., 2016). Although WFT is becoming more popular with young college female millennials, most studies continue to be focused on the quantitative aspects of the WFT; however, the experiences of WFT use by young female college students and their intent for behavior change has not been well researched.

## Purpose of the Study

The purpose of this study was to examine the lived experiences of young female college students' intent for behavior change with the use of WFT. Although behavioral changes using WFT have been examined in previous studies, most cluster female and male participants in one homogenous group (Colgan, Bopp, Starkoff, & Lieberman, 2016; Jakicic et al., 2016; Rupp et al., 2016; Stephens et al., 2015). However, female college students have different characteristics and opinions about their health than their male counterparts (Colgan et al., 2016). Therefore, in this study the participants were female college students, age 18-25, and their lived experiences and intent for behavior change with the use of WFT. Understanding female college students' lived experiences of intent for behavior change with the use of WFT is essential for reducing the health disparities in this population.

## Research Questions

The study was guided by three research questions.

Research Question 1: What is the intent of young female college students with the use of WFT?

Research Question 2: What are young female college students' lived experiences with the use of WFT?

Research Question 3: What are the lived experiences of WFT use by young female college students and their intent for behavior change?

## Theoretical Framework

The theoretical framework for this study was the health belief model (HBM), developed in the 1950s by social psychologists (Glanz, Rimer, & Viswanath, 2015; Skinner, Tiro, & Champion, 2015). The HBM is used extensively in social science research to predict health-seeking behaviors (Jones et al., 2015). The basic constructs of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action of the HBM provided a guide for developing interview questions, interpreting results, and describing the lived experiences of young female college students and their intent for behavior change with the use of WFT.

The use of this theory allowed me to examine young female college adults' experiences of WFT and perceived severity or perceived susceptibility of health inequalities. The HBM's construct of self-efficacy may reflect confidence and motivational behavior of the use of WFT by young female college adults. Perceived benefits and perceived barriers of the use of WFT are in alignment with the HBM (Barley

& Lawson, 2016) and provide insight in identifying data to design effective and successful program interventions for the health issues in young female college adults. Positive feedback and self-monitoring have been found to be strong predictors of successful behavior change in studies related to physical activity and young adults (Payne, Moxley, & MacDonald, 2015); therefore, the HBM was significant for this study.

## Nature of the Study

The nature of this study was a qualitative focus with a phenomenological method. This approach was best for examining the lived experiences and health beliefs of young female college adults and the use of WFT. The purpose of this phenomenological research inquiry was to determine the significant and common meaning of the lived experiences of young female college students who use WFT (Glanz et al., 2015). The use of phenomenology was appropriate to focus on a detailed, in-depth description of young female college students and their use of WFT.

Relative to the research questions, data were collected using semistructured, face-to-face interviews, composed of open-ended questions. Data were analyzed though transcribing textual data, memoing, coding, and searching comparative words and phrases, to reveal inductive and emergent themes using the computer software program, NVivo Pro 11. Hence, this approach allowed young female adults, 18-25 years old, attending tertiary education, to share their experiences of the use of WFT, which allowed me to gain a thorough understanding of the phenomenon.

**Definitions**

*Accelerometry*: Currently denotes the most accurate and reliable method for objectively measuring the amount and intensity of physical activity ant the amount of sedentary behavior (Elmesmari, Martin, Reilly, & Paton, 2018).

*Bioelectric impedance*: The most widely used indirect measurement method for assessing visceral and total body fat (Zhang, Wang, Chen, Wang, & Zhu, 2017b).

*Communicative social attentiveness*: The focus of online networking communication by young adults (Vorderer et al., 2016).

*Free-living conditions*: A range of activities that individuals do on a day-to-day basis, including work and at home.

*Indirect calorimetry*: The gold standard method to determine energy expenditure (Eslamparast, et al., 2018).

*Kilocalories*: A measure representing dietary energy intake (Rosinger, Herrick, Gahche, & Park, 2017).

*Macronutrients*: Carbohydrates, proteins, and lipids (Silveira, et al., 2018).

*Metabolic syndrome*: A cluster of coexisting cardiovascular disease risk factors, including obesity, dyslipidemia, hypertension, and impaired glucose metabolism (Ahola, et al., 2017).

*Multi-tasking paradigm*: When young adults conduct multitasking interactive actions using wearable fitness technology (Zhang & Rau, 2015).

*Obesogenic environment*: Aspect of the built and food environment that is related to or contributes to overweight and obesity (Townshend & Lake, 2017).

*Polysomnography measurements*: The frequency and duration periods of pharyngeal collapses per hour during sleep (de Raaff, et al., 2017).

*Prehypertension*: Defined as the systolic BP (SBP) 120–139mm Hg and/or diastolic BP (DBP) 80–89mm Hg3 and highlights individuals at high risk of cardiovascular disease associated with morbidity and mortality (Seow, Haaland, & Jafar, 2015).

*Real-time feedback*: Information from WFT that is available in real-time, providing users with immediate, customized goal-oriented feedback (Cooper, M., & Morton, J. (2018).

*Virtual coaching*: Wearable fitness technology's virtual coaching capabilities of personalized advice based on the users collected data (Wortley, An, & Nigg, 2017).

## Assumptions

The first assumption was that young female college students would find value in this study and will truthfully discuss their experiences and answer the interview questions appropriately, justly, and openly related to the use and experiences of WFT. A second assumption was that the interview questions would produce appropriate responses from the participants.

## Scope and Delimitations

The scope of a study refers to the boundaries in which the qualitative study is conducted and the phenomena the researcher used to understand which fits within the limitations, such as specific populations, sample size, geographic location, aspects, criteria, and settings (DePoy & Gitlin, 2015). This phenomenological study was conducted to address a gap in the literature of young college-age females and their experiences of the use of WFT. In addition, the study was conducted to evaluate differences and similarities in their lived experiences of the use of WFT and to better understand what the essence of the experiences is like for them.

Eligible participants for the study were female college students, 18-25 years of age, who wear and collect data from a WFT device. This study was limited to approximately 10 young adult females, age 18-25, attending colleges, technical schools, and universities located in a small city in northern West Virginia. A purposeful sample of participants were recruited who own and have experience with the use of WFT, had actively participated in physical activity for a minimum period of 6 months, and self-monitored and collected data from a WFT. The study was focused on young college females because of their low performance of recommended physical activity (Gu, Zhang, & Smith, 2015; Xiangli et al., 2015) and their unhealthy snacking behaviors during tertiary education (Downes, 2015).

A delimitation within the study was the exclusion of male college students because several studies have indicated that female college students perform less physical activity and have a higher incidence of health-related issues than male college students (Allom, Mullan, Cowie, & Hamilton, 2016; Pellitteri, Huberty, Ehlers, & Bruening, 2017).

## Limitations

Phenomenological research has some limitations. A purposive sampling method was used, making the generalizability of the study limited to only this sample population.

The female college participants recruited from colleges, technical schools, and universities within the small city in northern West Virginia, or surrounding areas, may not be representative of the overall population of young college females. The small sample and the fact that the participants were all female will make it difficult to apply the findings to other young college females, as the interview responses from a small sample are dependent on only the participants recruited for the study.

There is potential bias to the study because I own and operate a fitness facility in a small city in northern West Virginia and have experience with the use of WFT. To address this bias, participants were recruited outside of the facility, and a professional and unbiased relationship was established for the study. With regard to researcher bias, I kept thorough records with clear, consistent, and transparent interpretations of data (Noble & Smith, 2015), accurate analytical comparison of likenesses and differences in experiences of the participants, and researcher memoing.

## Significance of the Study

This research addresses a gap in understanding the intended use of WFT in young female college adults. The study results provided an understanding of female college students' use of WFT for tracking and self-monitoring their physical activity (Gowin et al., 2015), as exercising has been an essential element in reducing health issues. The results of this study can provide valuable contextual data for other researchers to address the current and future concern of increased health inequalities in young college adults, aged 18-25 (Abraham & Harrington, 2015).

**Summary**

Young female college students are exposed to a vulnerable environment that engenders adoption of unhealthy behaviors related to chronic disease. Understanding the use of WFT during this age period is important for further research related to being overweight and being obese, type 2 diabetes, hypertension, stress, and high cholesterol in young college females. As this generation is technologically-advanced, the use of WFT during daily activities provides a strong prevention strategy which easily motivates them. Therefore, this phenomenological qualitative study was conducted to explore the lived experiences of young, female college students and their use of WFT. Chapter 1 included a synopsis of the purpose, nature, and significance of the study. Moreover, Chapter 1 provided an understanding of the conceptual framework, research questions, and potential limitations. Chapter 2 includes a restatement of the problem and purpose and provides an outline of current literature relevant to young adult female college students and the use of WFT.

# Chapter 2: Literature Review

## Introduction

This phenomenological study was a qualitative examination of the lived experiences of young female college students and their intent for behavior change and use of WFT. Female college students, 18-25 years of age, are entering a period of independence related to their healthcare responsibilities. Most female college students acquire sedentary behaviors (VanKim et al., 2016) and eat an unbalanced diet (Aceijas, Waldhäusl, Lambert, Cassar, & Bello-Corassa, 2016), increasing vulnerability to poor health outcomes (Colby et al., 2017). Physical inactivity can increase prevalence of numerous health issues, such as being overweight and being obese, hypertension, type 2 diabetes, and high cholesterol in young female college students (Jung, Hyun, Ro, Lee, & Song, 2016). Price et al. (2016) documented that 31% of female college students are overweight or obese, as declining physical activity and unhealthy eating habits are health-related behaviors adopted by this population.

WFT, devices that track multiple fitness activities and promote social interaction, have been shown to be an effective method for motivating young adult female college students to increase physical activity (Michaelis et al., 2016) and create awareness of nutritional and caloric goals (Simpson & Mazzeo, 2017). The value of WFT is gaining recognition regarding the growing evidence of the importance of physical activity and nutrition in young female college students related to positive health outcomes (Santa Mina, 2017). Therefore, the purpose of this study was to better understand the lived experiences of female college students, age 18-25 years, and their use of WFT.

In Chapter 2, I describe the literature related to young college females and their use of WFT. I also discuss the strategy for the literature research, key search terms, databases, and search engines used to generate peer-reviewed articles related to the phenomena. The use of the HBM, which was the theoretical foundation for this study, is also discussed. Furthermore, this chapter includes current literature relevant to female college students, their health, and characteristics of WFT. This chapter concludes with a summary detailing major themes in the literature and current data related to the phenomenon. This chapter provides literature to connect a gap in the current literature of experiences of female college students and their use of WFT.

## Literature Search Strategy

The literature review was conducted to gain access to peer-reviewed articles and resources using Internet search engines including Walden University's Online Library, Google, and Google Scholar. Databases used within the Walden Library included Medline with full text, CINAHL & MIDLINE Simultaneous Search, CINAHL with Full Text, Cochrane Database of Systematic Reviews, EBSCO Open Access ProQuest Nursing & Allied Health Service, ProQuest Health & Medical Collection, PubMed, Sage Research Methods, ResearchGate, and Science Direct. Articles were also retrieved from the World Health Organization.

The searches identified full-text, peer-reviewed articles published from 2015 through 2018. Searches were based both on single terms and a combination of terms. Search terms for the sections related to the HBM and the use of HBM in WFT studies included *HBM, HBM and physical activity studies, HBM and millennials, HBM and* *fitness trackers, HBM and wearables, HBM and Fitbits,* and *HBM and quantification of specific aspects of the user's experiences of WFT.*

For the sections related to WFT, the following search terms were used: *wearable fitness trackers, validity of wearable fitness trackers, reliability of wearable fitness trackers, types of wearable fitness trackers, trends in wearable fitness trackers, cost of WFT, types of WFT, brands of WFT, activity trackers, wearable activity trackers, reliability and validity of WFT, acceptance of WFT, compliance and WFT, adherence to WFT, adoption of WFT, brands of WFT, Fitbit, Garmin, Jawbone, accelerometer,* and *affordability of WFT*.

For the sections related to obesity in young college females, type 2 diabetes in young college females, hypertension in young college females, high cholesterol in young college females, and stress in young college females, the following search terms were used: *millennials, net generation, young adult females, female college students, health-related issues of female college students, overweight in female college students, obesity epidemic, obesity in college students, obesogenic environment, hypertension in female college students, high blood pressure in young females, type 2 diabetes in female college students, high cholesterol in female college students, adverse lipids in young females, hyperlipidemia in young females, cardiovascular disease in young college females, stressors of young college females, stress-related health issues of young college females, psychological distress in young college females, chronic disease issues in young college females, health inequalities in young college females, health inequities in young college* *females, body image, body mass index, eating habits and health issues,* and *physical activity and health issues.*

In the section related to physical activity in young college females, the following search terms were used: *physical activity recommendations for young adults, barriers to physical activity in young college adults, exercise habits of young college females, self-motivations for physical activity, self-monitoring of physical activity, exercise habits, cardiovascular exercise in young college females, aerobic exercise in young college females, strength training in young college females, reducing chronic disease through physical activity, physical activity education and knowledge related to health issues, college fitness and exercise facilities, education on physical fitness related to chronic disease, obesity and overweight and physical fitness, hypertension and physical fitness, high cholesterol and physical fitness,* and *stress and physical fitness.*

In the section related to nutrition and young college females, the following search terms were used: *nutrition in young college females, dietary recommendations for young adults, eating behaviors of young female college students, snacking in college students, poor eating habits in young college females, campus foods, fast foods, fruit and vegetable intake of young college students, sugary sweet beverage preferences of young college students, nutrients, calories, obesity and food intake in young college females, hypertension related to poor eating habits in young college females, high fatty foods related to high lipids in young college females,* and *stress eating in young college females.*

## Theoretical Foundation

### Health Belief Model

The HBM is a theory developed by social psychologists to understand why individuals underuse prevention screenings that could improve their health (Champion, Lewis, & Myers, 2015; Rosenstock, Strecher, & Becker, 1994). The HBM has an intuitive logic and central components and was originally developed to understand why people did not seek tuberculosis screening when it was available to them (Glanz et al., 2015). Rosenstock et al. (1994) stated that the HBM has been one of the most widely used psychosocial approaches for explaining health-related behaviors. The HBM was also developed to explain which beliefs should be targeted in health communication campaigns to cause positive health behaviors (Carpenter, 2010). The HBM is used to study health behaviors to better understand why or why not individuals act to prevent health-related disparities (Yue, Li, Weilin, & Bin, 2015). The constructs of the HBM consist of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action (Rahmati-Najarkolaei, Tavafian, Gholami Fesharaki, & Jafari, 2015). For this study the construct of *cues to action* was not used.

The HBM is a comprehensive framework that has been effective in disease prevention and reveals the relationship between beliefs and behaviors with the assumption a preventive behavior is based on personal beliefs (Tavakoli, Dini-Talatappeh, Rahmati-Najarkolaei, & Fesharaki, 2016). Accordingly, the HBM can be used to suggest that individuals will follow health recommendations when they become motivated and believe they are susceptible to disease or if perceived benefits outweigh perceived threats (Tavakoli et al., 2016).

The HBM has been successfully used to predict physical activity in several studies (Mo et al., 2016; Rezapour, Mostafavi, & Khalkhali, 2016; Villar et al., 2017) and continues to be an important theoretical foundation in qualitative research. Furthermore, the HBM is one of the most effective and oldest behavior change models (Ramezankhani et al., 2016). Thus, the HBM was an appropriate choice for the phenomenological qualitative study on young female college students' lived experiences and their intent for behavior change with their use of WFT.

**The Use of the Health Belief Model in Physical Activity Studies**

Rostamian and Kazemi (2016) used the HBM as a theoretical framework for their study to evaluate the relationship between the level of physical activity among young males and females and their health beliefs. The authors indicated that obesity was higher in females than males among the student population and that young females did not meet the required amount of physical activity, exposing them to health-related issues. Results from the study were that, among young females, perceived threat and self-efficacy were reinforcing factors of increased physical activity. Rostamian and Kazemi specified that self-efficacy is an important construct in the frequency of physical activity of young college females. They indicated that researchers should take into consideration the HBM constructs of self-efficacy and perceived barriers for further research related to physical activity in this population. Self-efficacy may affect perceived barriers, a determining factor for physical activity more in young college students than any other age group.

Rostamian and Kazemi concluded that increased physical activity programs among young females could only be successful if there is a focus on perceived risk of inactivity, creating an environment for decreasing perceived barriers, increasing levels of self-efficacy, and creating opportunities for positive observational learning from positive role models.

Rahmati-Najarkolaei et al. (2015) used the HBM in their study of college students to identify the important predictors of physical inactivity and unhealthy eating, both determinants for cardiovascular disease. In their qualitative study, they used a proportional quota sampling and a self-administered questionnaire consisting of questions regarding the HBM, including perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy (Rahmati-Najarkolaei et al., 2015). They concluded that, for physical activity, perceived severity of cardiovascular disease could affect this behavior more than any other construct. Furthermore, they revealed that perceived barriers predicted physical activity and included factors such as lack of time and homework, common barriers of young female students (Pei-Tzu et al., 2015). Accordingly, the perceived benefits of physical activity, such as positive health outcomes, are affected by the perceived barriers for this population. Rahmati-Najarkolaei et al. concluded that self-efficacy and self-belief determinants also predicted level of physical activity.

Rezapour et al. (2016) used the HBM to investigate the effects of physical activity educational programs on increasing exercise and reduce being overweight and obesity in young adult male and female students. They stated that the most effective obesity and physical activity prevention strategies for young students should include theory-based health education. Their findings indicated that the constructs of the HBM can be effective in physical activity programs to increase physical activity and reduce being overweight and being obese. Moreover, they concluded that theory-based health-related education can be effective in increasing young adult students' awareness of the perceived benefits of meeting recommended physical activity requirements to reduce health-related issues.

**The Use of Health Belief Model in Wearable Fitness Technology Studies**

Butler et al. (2015) used the HBM in a study to explore self-efficacy in a college wellness program on physical fitness, aerobic fitness, and cardiovascular risk factors. The study included cardiovascular health assessments, questionnaires, data collected from WFT, educational sessions, and participation rewards (Butler et al., 2015). The WFT device was used as a diary to retrieve all participants' physical activity information with specific goals for encouragement (Butler et al., 2015). Both the Barriers Specific Self-Efficacy Scale and the Multidimensional Outcome Expectations for Exercise Scale were used in the study to quantify perceived capability of physical activity and assess physical activity outcome expectations. The program successfully increased physical activity and improved aerobic fitness over a period of 8 weeks. Weekly education and health assessments addressed perceived susceptibility, and educational classes and WFT-based activities addressed perceived benefits and barriers to enhance self-efficacy. Butler et al. concluded that there were improvements in self-efficacy related to physical activity outcomes; however, there was little improvement in participants' confidence to overcome perceived barriers of physical activity.

Obesity in young college females is rapidly rising due to physical inactivity. Obesity is an important factor leading to chronic diseases, such as type 2 diabetes, hypertension, and high cholesterol (Rezapour et al., 2016). Therefore, benefits of physical activity by young college females are associated with longer life expectancy and prevention of chronic disease. Using a theoretical framework such as the HBM for this study helped me identify themes related to the perceived susceptibility, perceived barriers, perceived benefits, and self-efficacy of physical activity behavior (Gourlan et al., 2016) of young college females related to the use of WFT. With the advances in WFT devices and the reliable and valid effectiveness of their use in collecting physical activity and nutritional information, young college females may benefit from adding the WFT to their daily lives (Sun, Zeng, & Gao, 2017).

## Key Variables

The population for the study was young college females, 18-25 years old. The key variables were physical activity, nutrition behaviors, and the use of WFT by this population. Additional variables were being overweight and being obese, type 2 diabetes, hypertension, high cholesterol, and stress in young college females. Constructs from the HBM were used in the study including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy. Each variable was discussed in the literature review.

## Wearable Fitness Technology

WFT devices are advanced models of pedometers that are more accurate and calculate more than just how far or how many steps people walk each day (Kaewkannate & Kim, 2016). Kaewkannate and Kim (2016) indicated that WFT devices are state-of-the-art processors that sync wirelessly to a computer for long-term tracking that users wear on various places on their bodies, such as wristbands, smart watches, bracelets, or clip-ons. The type of WFT that constitutes the largest slice of the market is smart wristbands (Nelson et al., 2016b). Nelson et al. stated that smart wristbands are readily available at a low-cost and sync collected data to a smartphone or smart tablet.

WFT was designed to increase individuals' awareness related to their daily physical activity behavior (Kooiman et al., 2015). WFT devices are user friendly and measure the amount of time spent performing different types of physical activity (Kooiman et al., 2015). WFT converts collected data using algorithms into measures of distance and can be linked to mobile applications to provide users with awareness and data of their daily physical activity. Over the past decade there has been an increase in both the quantity and variety of WFT for consumer purchase (Kooiman et al., 2015). Additionally, there is an assortment of WFT that monitors physical activity and includes an interface to monitor calories (Jakicic et al. 2016), heart rate, and sleep tracking (Kaewkannate & Kim, 2016).

WFT offers a range of uses including monitoring steps, floors climbed, calories burned, and sleep monitoring (Fotopoulou & O'Riordan, 2017). WFT offers the user a social connection for uploading data to a cloud-based system, which are computer systems where users can view daily fitness charts and personal weight loss goals (Fotopoulou & O' Riordan, 2017; Nelson, Kaminsk, Dickin, & Montage, 2016a). WFT allows the user to make comparisons of their individual health-related goals (Nelson et al., 2016a). Stored data from the WFT provides a visual mode to allow users to measure progress, be aware of their most up-to-date physical activity, and share this data with other users in a social media platform for motivation and everyday health-related support (Shih, Han, Poole, Rosson, & Carroll, 2015).

Availability and popularity of WFT is growing (Reid et al., 2017). In 2014, it was estimated that 19 million devices were sold, and this number is forecast to triple by 2018 (Reid et al., 2017). The economic growth of the WFT market has been predicted to top five billion dollars by 2019 and $40 billion in consumer sales by 2020 (Butler & Luebbers (2016); Cheon et al., 2016). Wrist-worn WFT devices are predicted to account for 87% of WFT shipped in 2018 (Wallen, Gomersall, Keatomg. Wasloff, & Coombs, 2016). Although the user interface design of the WFT wrist-worn device is suggested to be simple, clear, and easy to navigate for users' comfort, navigation can be difficult because the wristbands interface is small and difficult to read easily, making the smartphone app that links to the WFT an important feature for users to access collected data (Kaewkannate & Kim, 2016). The most popular WFT devices on the market during this study were Fitbit, Jawbone, and Garmin; however, Fitbit and Jawbone make up 97% of the consumer market (Butler & Luebbers, 2016; Evenson, Goto, & Furberg, 2015; Kaewkannate & Kim, 2016). Additional WFT brands include Apple and Polar.

## Wearable Fitness Technology Brands and Characteristics

### Fitbit

The Fitbit is a WFT device that can be worn 24 hours a day and provides access to an online database on which the user can view daily activity outputs, join community groups, and interact with friends or other users (Sushames, Edwards, Thompson, McDermott, & Gebel, 2016). The Fitbit is a popular consumer-based WFT as it is inexpensive, user-friendly, has numerous additional features to steps and distance, including sleep duration, nutritional breakdowns of food logs, and estimation of kilocalories burned in response to activity; all characteristics that can become motivators for the user (Sushames et al., 2016).

The Fitbit company offers several trackers that can be worn at the waist, wrist, pocket, or bra (Fitbit, 2017). The Fitbit trackers have accelerometers, altimeters, heart rate sensors, a global positioning system (GPS) monitor, and uses patented algorithms to collect data that measure the user's steps, distance, physical activity, kilocalories, and sleep (Evenson et al., 2015). The Fitbit Flex 2 is a wearable wristband that tracks steps, distance, calories burned, active minutes, hourly activity, and stationary time, automatically tracks activities like running, sports and aerobic workouts, and allows the user to view physical activity summaries in the Fitbit app (Fitbit, 2017). The Fitbit Flex 2 automatically tracks how long and how well the user sleeps, allows the user to set an alarm, and can be worn during water activities as this WFT device is waterproof (Fitbit, 2017). This WFT also alerts the user when they have an incoming text or phone call by vibration or by a light-emitted diode display of flashing colored lights (Fitbit, 2017). To help users stay active throughout the day the Fitbit Flex 2 sends reminders to move every hour and has a long battery life of 5 days (Fitbit, 2017).

More advanced, the Fitbit Alta has identical features to the Fitbit Flex 2; however, this wristband features an organic light-emitted diode display when tapped allowing users to get instant access to their stats, time, and notifications in real-time (Fitbit, 2017). Upgrading once again, Fitbit Alta HR adds a heart rate monitor that uses heart rate zones to display effort during physical activity, and displays sleep patterns of light, deep, and rapid eye movements sleep (Fitbit, 2017). The Fitbit Charge 2, the top of the line, has all the basic features of the earlier noted models but adds an additional specific multi-sports mode to track exercises like running, weights or yoga, a connected GPS to display real-time run stats like pace and distance, and automatically records select exercises like hiking and biking (Fitbit, 2017).

**Jawbone**

The Jawbone WFT device is worn at the wrist, except for the Jawbone UP tracker, which can be worn at the waist, pocket, or bra (Evenson et al., 2015). Evenson et al. reported that the Jawbone has a triaxle accelerometer that collects data and a bioelectrical impedance that measures heart rate, respiration, skin response, and atmospheric temperatures. They reported that the Jawbone measures steps, distance, physical activity, kilocalories, and sleep.

The WFT designed by Jawbone includes four versions: The Jawbone UP, Jawbone UP 2, Jawbone UP 3, and Jawbone UP 4 (Jawbone, 2017). The base model of the Jawbone UP is a small textured disk that can be worn as a clip-on or popped into a wristband; this WFT tracks physical activity, calories burned, and has access to Smart Coach (Jawbone, 2017), which is a system that keeps track of the users' progress of goals, offers personalized guidance to reach the goal quicker, and vibrates as a reminder to get up and move when there has been a long period of inactivity (Epstein, 2015). The Jawbone UP features an LED display that lights up when the tracker is active (Jawbone, 2017). Data collected by the device is synced simultaneously to the Jawbone UP app as it is always connected to the user's smartphone for real-time progress reports (Jawbone, 2017). The Jawbone UP app displays a home screen that provides immediate feedback to the user on daily activity, allows the user to set goals, record activity, set reminders for activity, and learn more information about their health from the Smart Coach tailoring messaging feature (Lewis et al., 2016). The Jawbone app also allows the user to scan bar codes on food packages for nutrition information (Epstein, 2015), log food and store menu items to evaluate nutrition, and challenge friends or other users to compete (Jawbone, 2017).

The Jawbone UP2 is a wristband that has the same features as the base model; however, this model also tracks light versus deep sleep, has a gentle vibrating alarm for wakeup, and tracks caffeine and how it affects the sleep cycle (Epstein, 2015). The Jawbone UP2 gives the user choices of strap design and color and the more the user wears the Jawbone and syncs collected data to the app, the more personalized the advice from the Smart Coach will become (Jawbone, 2017). The Jawbone UP3 is also a wristband with the basic features of both the Jawbone UP and Jawbone UP2 with an added feature to monitor the users heart rate (Jawbone, 2017). The Jawbone UP3 is designed to give the user heart health data such as measuring the users resting heart rate. The additional upgrade of the Jawbone UP4 compared to the other WFT devices made by Jawbone is the ability to link an American Express Card to the band to make purchases (Jawbone, 2017).

**Garmin**

Garmin makes a variety of WFT devices. The basic Garmin WFT wristband model and most inexpensive is the Vivofit which shows steps, calories, distance, and time of day on front display, monitors sleep, tracks intensity of physical activity, displays reminders when the user has been inactive for one hour, and syncs automatically to the Garmin Connect app to save, plan and share progress (Garmin, 2017). The Move IQ technology used in the Garmin automatically captures walking, running, biking, swimming, and elliptical movements and syncs this to the Garmin Connect app, which can be accessed on a smartphone or desktop computer, to view detailed data or join challenges to compete with others (Garmin, 2017). The Vivofit follows the users progress 24/7, is water resistant, has a large collection of stylish bands, acquires the user’s current activity level to assign daily goals, and allows the user to get healthy tips from experts or virtual coaches (Garmin, 2017).

The Garmin Vivosmart has the same basic fitness monitoring as the Vivofit. Additionally, this WFT tracker has a heart rate monitor, and fitness monitoring tools such as $VO^2$ max estimate, an estimate of the user’s fitness age, stress tracking, relaxation-based breathing timer, and tracks heart rate variability which is used to calculate stress levels (Garmin, 2017). The Vivosmart can also count repetitions, sets, and work and rest times during strength training that sync automatically to Garmin Connect (Garmin, 2017). The Vivosmart displays e-mails, text messages, daily progress, and physical activity challenges though social media. The Vivosmart Heart Rate and the Vivosmart Heart Rate Plus have the same features as the Vivosmart with the additional features of a heart rate monitor and a GPS that tracks distance and pace, while mapping out activities, and signals alerts from the user's social media community and connections (Garmin, 2017).

**Apple Watch**

Apple makes a variety of WFT. The Apple Watch Series 1 tracks your steps, measures your workouts, and tracks calories and energy expenditure (Apple, 2018). This series is unique as it has a dual-core processor featuring Stand, Move, and Exercise rings that gives the user a visual of daily movements and can be shared with friends (Apple, 2018). The Apple Series 1 also has smart coaching features with monthly challenges to inspire the user to reach their goals. Users can choose from a variety of workouts and every movement is accurately measured, receive daily summaries of all activity, and monitor heart rate (Apple, 2018). This series alerts the user when they have a phone call or text message and is voice activated.

The Apple Watch Series 3 has all the features of the Series 1 with additional features that allow the user to meditate, wear in open water, and answer phone calls or text messages (Apple, 2018). With built-in cellular, this series is connected to Apple Music for streaming, has GPS, lets the user train with in-ear coaching, syncs wirelessly to compatible gym equipment, and ask Siri questions (Apple, 2018).

**Polar**

The Polar M430 monitors heart rate and tracks speed, distance and pace (Polar, 2018). This WFT also has a scientifically-validated Smart Coach feature and long-lasting battery life (Polar, 2018). The Polar M430 tracks quality of sleep and gives the user over 100 different options within its sports profile to choose aerobic and anaerobic activities. Additionally, the Polar M430 connects to Bluetooth and allows the user to see messages and phone calls.

An upgrade for Polar is the A370 that monitors heartrate, calories burned, advanced sleep tracking, GPS, notifications for incoming calls, fitness testing, and feedback gained from training specificity (Polar, 2018). This WFT also lets the user choose training plans for running. The Polar 600 is the advanced model that is waterproof, has Smart Coaching features that turn the user's activity into training data, GPS, and messages and phone calls (Polar, 2018). This model allows the user to monitor their heart and has 4GB of storage for music playback.

**Step Counting**

The reliability and validity of WFT is vital if they are considered useful tools for individuals to self-monitor physical activity and be used as a potentially inexpensive alternative to research-based monitoring (Reid et al. 2017). Reid et al. conducted a study to investigate the accuracy of Fitbit One and Fitbit Flex against the previously validated ActiGraph GT3X. They evaluated the inter-device reliability to measure light, moderate, and vigorous physical activity in young adult females of both the Fitbit Flex and Fitbit One, on two different wear-locations, including the hip and bra, and in free-living conditions, which differ from conditions in a laboratory. They described free-living conditions as a range of activities that individuals do on a day-to-day basis, including work and at home. The ActiGraph GT3X is an accelerometer used to measure steps, moderate-to-vigorous physical activity, and physical activity energy expenditures (Sushames et al., 2016). Sushames et al. indicated that the ActiGraph GT3X is worn on the user's preferred hip attached to an adjustable elastic belt and was used to develop the current national physical activity recommendations. Reid et al. stated that consumer-based devices such as the Fitbit offer low-cost monitoring of activity similar to the expensive research-based accelerometers such as the ActiGraph GT3X. They concluded that both Fitbit One and Fitbit Flex monitors are as accurate as the ActiGraph GT3X in measuring steps and that there was excellent reliability between devices. They also indicated that even though the Fitbit was worn in different locations, it was a reliable device, allowing consumers to choose the wear-location suitable for them.

As it is important to have reliability and validity of WFT, Diaz et al. (2015) conducted a study to investigate if the Fitbit met practical validity and reliability standards to accurately measure and monitor patients' physical activity between visits with their primary care physicians. Participants wore either three Fitbit One trackers on their hips, two on the right and one on the left, and the Fitbit Flex on both the right and left wrists (Diaz et al., 2015). They concluded that the Fitbit One and the Fitbit Flex rationally and reliable estimated step counts and energy expenditure during walking and running. They indicated that the wireless interface and syncing capabilities of the Fitbit to mobile devices to share collected data with their physicians may be an accurate, efficient, and reliable tool for primary care physicians to support their patients' active lifestyle.

Similarly, Gomersall et al. (2016) conducted a study to compare Fitbit One estimates of number of steps, moderate to vigorous physical activity, and idle time with data collected from the ActiGraph GT3X+ accelerometer in a free-living setting. Gomersall et al. suggested since WFT is widely used in both the general population and research settings and has significant potential to enable healthy behaviors through self-tracking of physical activity, it is crucial that WFT devices measure what they propose to measure. They concluded that there was moderate to strong agreement between the Fitbit One and the ActiGraph GT3X+ for the estimation of steps taken daily. They indicated that although there were over and under estimates of moderate to vigorous physical activity, the Fitbit One showed acceptable accuracy when compared to the ActiGraph GT3X+.

The purpose of the study by Dontje et al. (2015) was to determine inter-device reliability of the Fitbit in measuring steps using the Fitbit Ultra. Ten Fitbit Ultras were worn by a single male, 46 years old, during eight consecutive days (Dontje et al., 2015). They assessed inter-device reliability on three levels of aggregation: minutes, hours, and days, using methods that included intra-class correlation coefficient, Bland-Altman plots, limits of agreement, and mixed model analysis. They concluded that the inter-device reliability of the Fitbit Ultra was good at all levels of aggregation when steps were measured per day, and that individuals can reliably compare their daily physical activity scores from the Fitbit Ultra with others.

Alharbi, Bauman, Neubeck and Gallagher (2016) conducted a study to examine the validity between the Fitbit Flex and the ActiGraph accelerometer for monitoring physical activity in both male and female participants in free-living conditions. Participants were eligible for the study if they had been diagnosed with coronary heart disease, engaged in 30 minutes per day of physical activity, and had sufficient English to understand the requirements and process of the study (Alharbi et al, 2016). Participants wore both the Fitbit Flex and the ActiGraph trackers simultaneously over four days to monitor their daily step count and track minutes of moderate to vigorous physical activity (Alharbi et al., 2016). They concluded that the Fitbit Flex is accurate in assessing the accomplishment of physical activity recommendations for cardiac rehabilitation patients and that the Fitbit Flex highly correlated with the ActiGraph in measuring step counts. They indicated that the Fitbit Flex precisely measured step counts in free-living conditions making this WFT device applicable to health-related prevention programs. Similarly, in a study to assess accuracy of different commercially available WFT devices in healthy volunteers and in patients recovering from chronic pulmonary obstructive disease (COPD), Prieto-Centurion et al. (2016) found that the Fitbit outperformed the ActiGraph exceedingly well in both populations.

Huang et al. (2016) conducted a quantitative study to assess step count and distance activity using the most popular consumer WFT devices including the Fitbit, Garmin, and Jawbone UP on a treadmill at various speeds, and walking flat, upstairs, and downstairs. Huang et al. suggested their study was the first to measure different elevations and speeds of walking using WFT devices. They stated during level walking the Fitbit and Jawbone Up was highly accurate with step count errors less than 1%. The Garmin Vivofit was the most accurate in estimating step count for walking upstairs with errors less than 4% (Huang et al., 2016). Walking speed had no influence on the Fitbit or Garmin Vivofit; however, they noted that the Jawbone WFT tracker underestimated step counts at slower walking speeds. However, several studies indicated that lower speeds could cause a smaller impact and possibly not register the step movement (Bassett, Toth, LaMunion, & Crouter, 2016; Nelson et al., 2016a).

Similarly, O'Connell et al. (2016) conducted a study to assess the step detection sensitivity of the Garmin Vivofit and Fitbit One in counting an actual step as a step, over a prescribed walking course that reflected different surfaces including natural grass, gravel, ceramic tile, asphalt, and linoleum, wearing both running shoes and hard-soled dress shoes. They suggested that if WFT devices are being used to quantify adherence to the daily number of recommended steps the tracker must be able to deal with different walking surfaces, different footwear, and walking for an extended time period. Participants for the study included fifteen healthy young adults with a mean age of 21.1 ± 1.1 years. They concluded that both WFT devices used in the study were accurate in step detection over different tested surfaces when wearing both hard-soled shoes and running shoes, and over an extended time period.

In their study, Kooiman et al. (2015) investigated reliability and validity of ten consumer WFT devices, including the Fitbit Flex and the Jawbone UP in both free-living and laboratory conditions. Both WFT devices were measured against the Optogait system, a gold standard accelerometer on the treadmill in a laboratory, and the ActivPAL, a gold standard accelerometer for measuring steps in free-living conditions (Kooiman et al., 2015). Participants for the study were healthy adults who were asked to wear WFT during their workday from 9:00 a.m. to 4:30 p.m. and then in the laboratory for a total of thirty minutes. Kooiman et al. concluded that the reliability and validity of most of the WFT used in the study were good for measuring step count; however, the Fitbit was the most valid. They also indicated that the validity and reliability of the Jawbone UP was good and that both WFT devices were suitable for individual usage during health prevention programs in measuring physical activity.

Thirty-one male and female college students were recruited for a study to investigate the accuracy of step count at varying gait speeds across different walking and running speeds using a Fitbit One, a Fitbit Flex, Fitbit Charge HR, the Jawbone UP, and the ActiGraphGT3X (Chow, Thom, Wewege, Ward, & Parmenter, 2017). Chow et al. reported that the Fitbit was the most accurate device in step count; however, the ActiGraphGT3X showed accuracy in step count across all walking and running speeds. They concluded that the WFT devices worn in this study varied in levels of accuracy depending on gait speed and placement site. Furthermore, they indicated that the Fitbit and ActiGraphGT3X devices, when worn on the waist, performed more accurately than the wrist worn devices.

An, Jones, Kang, Welk, and Lee (2017) conducted a study to provide data on accuracy and validity of step measurement in ten activity trackers including Fitbit Flex, Jawbone UP, and Garmin Vivofit. An et al. examined measurements for walking on a treadmill, walking on an indoor track, and free-living conditions. Participants wore all 10 activity trackers at the same time for treadmill walking and indoor track walking and wore three trackers given to them randomly for the 24-hour free-living conditions. They concluded that the Fitbit Flex was more accurate than the Garmin Vivofit for step count measurements under all three conditions. However, Šimůnek (2016) investigated the validity of the Garmin Vivofit compared to previously validated accelerometers during free-living conditions and found the Garmin Vivofit to be the more accurate of the two devices and indicated the Garmin Vivofit was a suitable alternative for future research in tracking and measuring steps.

**Energy Expenditure**

Bai et al. (2016) conducted a study to evaluate the validity of WFT devices during semistructured periods of sedentary activity, aerobic exercise, and resistance exercise in male and female college students against the ActiGraph GT3X+. The two wrist-worn WFT devices tested in the study, the Fitbit Flex and Jawbone UP, tracked steps and recorded total energy expenditure. The Jawbone UP and Fitbit Flex additionally tracked resting and active energy expenditure separately, along with sleep quality and duration. They indicated their study was untraditional in validating the reliability and validity of energy expenditure in WFT devices as participants were given the option to select the type and intensity of preferred activity for all three contexts. They concluded that the Fitbit Flex and Jawbone UP provided comparable accuracy for estimating total energy expenditure. They noted that the Fitbit Flex and the Jawbone UP yielded comparable errors for individual energy expenditure estimation as the ActiGraph GT3X+ and the mean bias and equivalence testing showed the Fitbit Flex and Jawbone UP provided similar validity. They reported that none of the WFT monitors accurately estimated energy expenditure during resistance exercise, a common form of recommended exercise that individuals should perform two or more times per week.

Chowdhury, Western, Nightingale, Peacock, and Thompson (2017) conducted a study to examine energy expenditure estimates from four WFT devices, including the Jawbone UP, Fitbit Charge HR, and Apple Watch in both a controlled laboratory setting and normal free-living conditions. Fifteen healthy female and male participants wore both consumer-based WFT devices and the research-based devices simultaneously. Since the Jawbone UP does not have a visual screen, data were collected through the online UP app and all other measurements were collected from the device itself (Chowdhury et al., 2017). The WFT devices were compared against the Actiheart, an accelerometer that has been used to measure free-living energy expenditure in epidemiology research, and the BodyMedia Core armband, which has been validated in previous research to accurately measure energy expenditure. They concluded that the Fitbit Charge HR provided good estimates of energy expenditure compared to research-level accelerometers; however, the Jawbone UP and Apple Watch underestimated energy expenditure in both the laboratory settings and the free-living settings.

The objective of the study by Alsubheen, George, Baker, Rohr, and Basset (2016) was to assess the validity and reliability of the Garmin Vivofit by a comparison of energy expenditure and step count to the gold standard methods of indirect calorimetry. Participants for the study were thirteen active and healthy male and female adults recruited from the local college, with each participant completing three physical activity sessions over five days. Alsubheen et al. indicated that the Garmin Vivofit provided valid and accurate estimates of basal energy expenditure and reported there was no significant difference between the Vivofit and the indirect calorimetry, concluding that the Garmin Vivofit is reliable and valid when tracking physical activity steps and energy expenditure.

Brooke et al. (2017) conducted a study to measure the concurrent validity of energy expenditure and sleep tracking in free living conditions of four brands of WFT including Garmin, Fitbit, Jawbone, and Polar against the SenseWear, a device that has been extensively validated with other criterion measures of energy expenditures in free living conditions and indirect calorimetry in laboratory settings. Brooke et al. stated that it is essential to determine the relationship between energy expenditure and sleep associated with health issues; therefore, there is a need for valid and reliability when WFT is used for measurement in physical activity studies. In order to participate in the study, the participants had to be able to perform daily physical activity without limitations. The participants were randomly assigned 2 or 3 different WFT based on availability. All participants were assigned the SenseWear and were worn on the left wrist each day for consistency. They concluded that many of the WFT devices were favorable in measuring energy expenditure. They indicated that the Polar was the most valid in measuring energy expenditure and the Garmin was the most valid for tracking sleep when compared to the SenseWear.

**Sleep Monitoring**

The purpose of a study by Lee, Lee, and Yeun (2017a) was to evaluate the applicability of data collected from the Fitbit Charge HR compared to the Actiwatch 2, an Atigraph wrist wearable tracker used in medical research for sleep evaluation. Participants for the study were young healthy adult females, mean age, 22.8 years, who wore both trackers on the same wrist over a 14-day period. Lee et al. compared sleep variables and circadian rest-activity with Wilcoxon signed-rank tests and Spearman's correlations and concluded that there was no difference in the collected measures from the Fitbit Charge HR and the Actiwatch 2. They also noted that there was high correlation between the Fitbit Charge HR and the Actiwatch 2 for all days suggesting the Fitbit Charge HR could be applicable as an alternative measuring tool for sleep evaluation.

De Zambotti, Baker, and Colrain, (2015) evaluated the accuracy in measuring nighttime sleep of the Jawbone UP compared to polysomnography, a technique used for evaluating sleep in research and considered to be the gold standard. The participants were young, healthy males and females, age 12-22 years. de Zambottie et al. indicated polysomnography is expensive, intrusive, time consuming, impractical for long-term data collection, and has limited availability. They stated these limitations have led to the development of other methodologies to objectively evaluate sleep, including WFT devices such as Jawbone UP, Fitbit, and Garmin. They concluded that the Jawbone UP has good agreement with polysomnography measurements in healthy young adults.

Ferguson, Rowlands, Olds, & Maher (2015) examined several WFT devices to assess coexisting validity for step count, moderate to vigorous activity, total daily energy expenditure, and sleep time against research-level accelerometers. Ferguson et al. stated that the consumer-level WFT devices were highly accurate for steps, moderate to vigorous activity, and energy expenditure, and, although most research-level accelerometers are used in studies; in their study, all the consumer-level devices were quite accurate for sleep quantity.

**Heart Rate Monitoring**

WFT have been found to offer accurate measures of both heart rate and energy expenditure and if individuals are using these devices to monitor energy balance they need to be accurate (Wallen, et al., 2016). In their study, Wallen et al. examined four WFT devices, including the most popular device, the Fitbit Charge HR, to determine the accuracy of measuring heart rate and energy expenditure at both rest and during physical activity. The participants for the study were healthy females, aged 24 ± 5.6 years, who completed the protocol for the study consisting of supine and seated rest, treadmill walking and running, and ergometer cycling. They concluded accuracy was moderate-to-strong for heart rate and weak-to-strong for energy expenditure for all devices and indicated that WFT offers individuals a convenient and acceptable method to monitor heart rate while performing physical activity.

The purpose of a study by Bai, Hibbing, Mantis, and Welk (2017) was to evaluate the validity of heart rate, energy expenditure, and step counting from two WFT including the Apple Watch 1 and the Fitbit Charge HR. The Oxycon Mobile 5.0., a wireless portable metabolic analyzer used to perform indirect calorimetry, was used to obtain criterion estimates of energy expenditure for the study (Bai et al., 2017). Additionally, the Yamax SW-200 DigiWalker, a pedometer of consistent accuracy in most walking speeds, was used as the step criterion measurement and the Polar H7 heart rate strap, validated in several studies with high validity, was used as the criterion measure for heart rate. Participants for the study were healthy adults aged 19-6o years of age. The study took place in a large gym setting. Each participant wore both WFT on the left wrist and performed an 80-minute protocol consisting of 20 minutes of sedentary activity, 25 minutes of self-paced aerobic activity, 25 minutes of free living activities, and two five-minute rest intervals. The results of the study showed that the Fitbit Charge HR had the best predictability of heart rate, the Apple Watch 1 estimated energy expenditure with comparative accuracy to the Oxycon Mobile 5.0., and both the Apple Watch 1 and the Fitbit Charge HR estimated accuracy in step counting during aerobic activity.

**Adoption and Continued Use of Wearable Fitness Technology**

Chung, Skinner, Hasty, and Perrin (2017) developed a health intervention for overweight and obese young adults using a Fitbit, and the Twitter social app, to pilot test combined use of facilitating support for healthy lifestyle changes. Participants in the study tracked physical activity and calorie intake using Fitbits and used Twitter for motivational messaging and completed surveys at baseline, 1 month, and 2 months (Chung et al., 2017). They revealed that young college students experienced high compliance to Fitbit wear, high sustainability rates of logging dietary, and that motivational competitions increased physical activity. They stated that the use of WFT to enhance self-monitoring was well received by the participants and can create countless possibilities for health-related prevention strategies in young college females. They noted that use of both WFT and Twitter provides a viable economic means to facilitate long-term healthy behavior changes. The use of WFT aides in self-monitoring and real-time tracking, is an essential construct of weight loss and physical activity adherence (Chung et al., 2017). In their study, they reported that compliance of young college females with daily device wear was 99% on all days. Canhoto and Arp (2016) suggest that the continual use for young adults and WFT devices may be that young adults are more willing to embrace and adopt this type of innovation as they are more task-oriented than older adults.

Canhoto and Arp (2016) investigated factors supporting the adoption and sustained use of WFT among the public who display an interest in maintaining a healthy life. They focused on factors related to the utility and characteristics of WFT and the context of usage and users. They suggested that adoption is still comparatively low and that many consumers abandoned their WFT device within the first 6 months. To better understand adoption of WFT, researchers need to consider not only the characteristics and utility of the technology, but also the context of usage and who the users are. They stated that, although practical benefits may be the key component of adoption, researchers should consider personal factors such as excitement and a feeling of independence and being in control. Karapanos, Gouveia, Hassenzaki, and Forlizzi (2016) also suggested that while adoption and adherence of WFT may increase steps, if it decreases the enjoyment that individuals derive from walking, this may pose a threat to everyday healthy behaviors. Karapanos et al. noted that researchers need an understanding of how WFT devices create and mediate meaningful experiences in everyday life.

Cadmus-Bertram et al. (2015) conducted a study to examine the adoption and acceptability of real-time feedback of the Fitbit One WFT device against the ActiGraph and the effect it had on physical activity in overweight and obese females. Data were collected from the online Fitbit app, which was modified to display only physical activity data (Cadmus-Bertrum et al., 2015). The intervention was based on a framework to identify self-monitoring, goal-setting, frequent behavioral feedback and other self-regulatory skills. They used this framework as it is the most important theory-driven element of successful behavior change. The participants self-monitored data, including goal-setting, and frequent feedback for four weeks. They concluded that all barriers and technical issues were resolved quickly and adherence to the Fitbit went well as participants indicated they liked the app and found that the tracker was sufficient for their needs.

Additionally, Kaewkannate and Kim (2016) compared the satisfaction, user friendliness, and accuracy of WFT devices including the Fitbit Flex and Jawbone UP based on experiences of real users. After the participants wore each device for a week, Likert scores were entered into an evaluation form, which included details about the features and properties of the devices and the user interface application. They concluded that the user interface application of the WFT device needs to be simple, clear, and easy to navigate for user convenience and usefulness. They suggested that WFT devices should be lightweight, waterproof, have options for recharging the battery, accuracy in monitoring physical activity, and have vital parameters such as heart rate, pulse rate, body temperature, and respiration.

Jeong, Kim, Park, and Choi (2017) indicated that young college students were early adopters of new technology more than any other demographic group. To understand acceptance of WFT in this population researchers need to examine physical, cognitive, and psychological features, such as ease of use, practicality, social acceptability, and how comfortable the device is. They indicated that WFT devices are fashionable and have technology components; however, young college students need the device to fulfill both functional and social needs. They conducted a research study to understand influence and psychological aspects of WFT adoption in female college students, who had never used a WFT device. They concluded that perceived usefulness and screen visibility significantly influenced adoption intention in this population.

**Millennial Female College Students Use of Wearable Fitness Technology**

Millennial college students have a higher use of technology than any previous generation, and see behaviors including tweeting and texting as a normal everyday part of their social lives (Coccia & Dalring, 2016). Young college students socialize on some type of technology up to 12 hours per day, and 83% of millennial college students sleep with their cell phones (Coccia & Darling, 2016). Coccia and Darling stated that the millennial college student is experiencing a historical period as the popularization of mobile communication devices, technology, and social media has changed how young college students interact and self-monitor their daily actions. They indicated that female college students report better time management skills than college males, tend to be more prosocial, yet tend to experience greater stress than college males. They stated that young college females communicate more through social media, talking on cell phones, and text messaging than college males.

Zhang and Rue (2015) conducted a study to better understand the role of display and gender differences in interactions with WFT devices. Thirty-six male and female participants, average age, 24.2 years old, used a WFT with a screen for visual display and without a screen, although both devices were connected to a social app on their phone. They found that female participants who used the WFT device with the screen reported to be more entertained than male participants and that their need to receive real-time visual feedback created more gratification than their male counterparts. The female participants found the WFT wristband device with the screen was easier to use and felt more comfortable on their arm as they usually wear more fashion accessories than males.

WFT devices such as Fitbit and Jawbone UP are more suitable for the young and healthy users that have higher insights on the enjoyment and ease of the device (Gao, Li, & Luo, 2015). Gao et al. indicated that young and healthy adults are more likely to monitor daily fitness data including steps and calories than older adults. They suggest young adult healthy WFT users are focused more on using the tracking device for prevention of being overweight and being obese and to reduce stress, rather than to reduce the perceived threats of chronic disease. They indicated that young adults who used WFT devices paid more attention to pleasurable motivation, usefulness, and social adaptability and influence.

The design of WFT has been targeted through health and lifestyle marketing towards young women as a lifestyle wear-accessory (Fotopoulou and O'Riordan, 2017). As an example, the Fitbit Flex shows a flower, has a smaller band, and the option to choose multiple colors. Additionally, Simpson and Mazzeo (2017) reported young college adults, ages 18 to 29 years old were more likely than younger or older individuals to use WFT, and young adult females were more likely to use the WFT devices than young males.

Middelweerd et al. (2015) stated there is little research on the usage, appreciation, and preferences of college students, 18-25 years of age, for features of technology-based WFT and related social apps. Therefore, they suggested that understanding the needs of this population, such as their expectations, general usage of WFT, technical aspects, and social sharing could be beneficial in physical activity interventions. In their qualitative study of general WFT usage, usage and appreciation of the WFT app, appreciation of and preference of features, and sharing of WFT collected data related to reaching goals through social media, 67% of the participants were female. They concluded that the students' appreciations and preferences may be valuable data for future technology-based physical activity prevention strategies.

Davis, DiCemente, and Prietula (2016) reported that 63% of millennials preferred to be proactive with providing health data from WFT to their physicians and 71% of millennials suggested they would be in favor of their primary care physician giving them a mobile app to actively manage their well-being for preventive care. Liu and Guo (2017) indicated more than half of all college students participating in physical activity intended to or had purchased some type of WFT. Munk (2015) reported millennials are the readiest to embrace technology and are the most interested in WFT.

**Tracking Physical Activity Using Wearable Fitness Technology Studies**

Self-tracking using WFT is the activity by which individuals voluntarily and autonomously monitor and record specific features of their lives. More specifically, it refers to the practice of gathering data about oneself related to bodily movements and daily habits, and analyzing the data to produce statistics (Pfeiffer, von Entress-Fuersteneck, Urbach, & Buchwald, 2016). Pfeiffer et al. (2016) indicated that self-tracking is not just meaningful in a normal or contributory, useful sense, but is also a source of pleasure and desire for the individual. Lomborg and Frandsen (2016) agreed that self-tracking is a shared and social practice that is basically communicative and the use of WFT has enabled individuals with a novel, familiar and easy means of self-tracking.

WFT can help young adults track and receive feedback of their daily activities in real-time and has the potential for use in a cost-effective strategy to increase physical activity (Shin et al., 2016). Furthermore, many advances have happened in WFT for monitoring physical activity and encouraging young adults to meet recommended physical requirements to achieve a healthy lifestyle (Coughlin & Stewart, 2016). One advance is the web interface, which allows the user to interact with friends, receive social support, or even complete group challenges (Coughlin & Stewart, 2016).

There is interest by researchers to incorporate WFT in lifestyle interventions to increase physical activity, decrease being overweight and being obese, and manage chronic health issues (Coughlin & Stewart, 2016). Highly educated young college adults find technology to be a new possibility for promoting physical activity, as there are a rapidly growing number of available fitness apps that sync with WFT (Middelweerd et al., 2015). Therefore, when WFT is used in physical activity interventions, including the ability for self-monitoring, goal setting, social support, and sharing data through social networking, young college students are more likely to participate (Middelweerd et al., 2015).

Real-time data feedback is important for promoting physical activity in young college adults. In their review of physical activity and behavior change using WFT, Sullivan and Lachman (2016) reported that framed messaging through WFT to increase physical activity are effective in the young adult population. Feedback and rewards from WFT can be used to motivate this population (Sullivan & Lachman, 2016). WFT is becoming progressively accessible to the young adult population and some studies are beginning to find positive results between reported physical activity and the use of WFT (Melton et al., 2016).

Schrager et al. (2017) measured the effectiveness of tracking physical activity using a WFT to monitor exercise habits, student wellness, and perceived barriers to adopt and continue use of WFT over a 6-month period. Primarily, the outcome measure was the change in the self-reported days per week of at least 30 minutes of physical activity, and the change in weekly physical activity, defined by the number of days per week with at least 30 minutes of active time or 10,000 steps measured by the WFT (Schrager et al., 2017). Schrager et al. concluded there was little change in the overall self-reported physical activity from baseline to 6 months; however, there was a significant overall improvement in the amount of physical activity for those participants who had less activity at baseline measurement, and improvements in overall stress, wellness, and physical activity were noted among the whole study population. In addition, one aspect of improvement in physical activity was the importance of perceived benefits, including a sense of accomplishment, strength, and reduced stress (Esslinger, Grimes, & Pyle, 2016).

Al-Eisa et al. (2016) investigated the efficacy of using social media as a motivational tool to improve physical activity adherence in young college females with an “Instagram” physical activity application. It is known that millennials have expert technologically-based skills and are motivated through social media interaction (Vaterlaus et al., 2015). Al-Eisa et al. hypothesized that motivation through social media using a physical activity app would increase adherence to physical activity in this specific population. Using a variety of social media techniques to educate participants about physical activity benefits, and Instagram to forward reminders to meet physical activity requirements each week, the researchers concluded although physical activity adherence was poor in young college females, the use of social media interaction could be an effective and motivational tool to support adherence of physical activity in this population (Al-Eisa et al., 2016).

Bice et al. (2016) stated that motivation concerning physical activity continues to be a topic of interest as motivation is a concept that leads individuals towards reaching their goals. Recently, research interest has been created regarding the influence WFT has on physical activity, as these devices provide an alternative approach of motivation due to their capability for instant and real-time feedback (Bice et al., 2016). In their study, Bice et al. recruited participants from a university, age 25 years or older, who had access to a computer for WFT syncing capability, could attend a pre-intervention training on the use of the WFT, and were able to use the WFT to track physical activity for 8 weeks. They concluded that there were significant changes in physical activity motivation with the use of the WFT. They reported important variables for explaining these motivational changes as enjoyment, challenge, affiliation, and positive health motivation and indicated WFT devices provide a cost-effective method for motivating individuals to change their health behaviors.

**Tracking Calories and Daily Energy Intake Using Wearable Fitness Technology**

Typically, body weight and energy expenditure are easily assessed; however, accurate and continuous measurement of real-time monitoring of daily energy intake remains a challenge (Weathers et al., 2017). Currently, several types of WFT have been developed to enable young college females to self-monitor calories (Weathers et al., 2017). Importantly, technology-based calorie monitoring can be an effective method for decreasing incidence of the high prevalence of obesity (Weathers et al., 2017) in young college females.

WFT and the use of calorie tracking is explosively increasing, as college students report that using WFT allows them to self-monitor consumption and nutritional data; these are important factors for reducing being overweight and being obese (Simpson & Mazzeo, 2017). In general, WFT can track dietary intake and includes data such as nutrient intake, calories burned, and daily dietary consumption, while providing an opportunity to track nutritional goals (Simpson & Mazzeo, 2017).

WFT can also be used for tracking food intake at the bite level, which is designed to track the number of times food is placed in one's mouth, defining food portion by bites (Weathers et al., 2017). Thus, Weathers et al. indicated that the number of bites registered by the WFT is positively correlated with caloric intake and provides accurate estimates of calories consumed. WFT, worn like a watch, tracks wrist motion and provides data on real-time measurements during eating (Jasper, James, Hoover, & Muth, 2016). Jasper et al. (2016) specified self-monitoring bite count feedback correlates with calories to provide real-time response which can lead to a reduction in overall consumption, reducing being overweight and being obese. Hence, the Bite Counter, a WFT, provides a computerized method of tracking wrist motion to gather data collection of kilocalorie intake estimation (Salley, Hoover, Wilson, & Muth, 2016). Wilson, Kinsella, and Muth (2015) reported that the WFT device is highly accurate when measuring eating behaviors in both home and laboratory meal settings. Weathers et al. concluded that tracking bites with a WFT did not reduce or distract from the enjoyment or the overall eating experience compared to previous methods of measuring food portions and calculating caloric intake.

Allman-Farinelli (2015) reviewed 14 nutritional interventions with most using some form of technology in young college students in correlation with nutrition. They concluded that the use of technology, such as social websites, text messaging, smartphone apps, and WFT might be an effective method for such a technologically-advanced generation. Accordingly, Allman-Farinelli found that, in a study of young adults 18-25 years, 40% of the participants viewed their eating behaviors as sufficiently consuming the right amount of fruits and vegetables, and 59% of young adults ate healthy during main meals; however, 89% ate unhealthy snacks that did not meet the expected outcome of a healthy diet. Thus, ways for this specific generation to improve their self-efficacy coping skills, increase outcome expectations and intentions of eating more fruits and vegetable, for increased awareness of benefits of healthy eating is to use cues to action through a familiar source of social interaction and technology, such as WFT and social media (Matthews, Doerr, & Dworatzek, 2016).

**Wearable Fitness Technology in Overweight and Obesity Studies**

As obesity is a complex disease, a causal factor that affects young college females is poor eating habits. An individual's behavioral aspects of nutrition include the type and quantity of food, caloric intake, and calories utilized by the body during physical activity, calorie expenditure (Gao et al., 2015). Managing the balance of caloric intake and caloric expenditure is essential to reduce obesity in young adults. The use of WFT to self-monitor and self-regulate calories is a motivator for behavioral change and positive association in this technologically-wired generation (Simpson & Mazzeo, 2017).

Prevention programs aimed towards being overweight and being obese in college students needs to be feasible and effective. Technology-based interventions such as the use of WFT, shows great potential as an efficacious and efficient modality for young college females (Mackey et al., 2015). Jakicic et al. (2016) stated that, although short-term studies have demonstrated that the use of WFT had some improvements in reducing overweight and obesity, the use of WFT in prevention strategies may provide a method to decrease long-term overweight and obesity. The outcome of using WFT is important to both individuals and society in general, yet there are few empirical studies substantiating this belief (Nelson et al., 2016b).

## Wearable Fitness Technology in Chronic Disease Studies

WFT devices are now readily available and many physicians are currently prescribing physical activity to individuals with hypertension (Sullivan & Lachman, 2016). WFT could be a successful module for young adult females to increase physical activity and reduce high blood pressure (Sullivan & Lachman, 2016). Similarly, data collected from WFT can be beneficial for young female adults with at-risk for hypertension as tracking weight, physical activity, and sleep allows students to change lifestyle behaviors, and live lengthier, healthier lives (Denwood, 2016).

Using WFT to collect physical activity data in females at-risk for CVD has been effective in interventions using self-monitoring and social connectivity (Dean, Griffith, McKissic, Cornish, & Johnson-Lawrence, 2016; Miller, 2017; Strunga, & Bunaiasu, 2016). In their study, Dean et al. (2016) concluded that moderate to vigorous physical activity significantly increased during a 6-month intervention using WFT, and that WFT is an effective tool for reducing CVD risk in young adults. Strunga and Bunaiasu (2016) indicated that WFT can be a significant instrument in addressing CVD in young college students, and that collected data from WFT motivates college students to lose weight and reduce the prevalence of CVD.

The use of WFT is being adopted to perform research focused on the detection of human features, including stress issues college students face (de Arriba-Pérez, Caeiro-Rodríguez, & Santos-Gago, 2016). Initiatives that involve analyzing WFT data to reduce stressors for students during educational contexts may be a successful option (de Arriba-Pérez et al., 2017). AlKandari (2016) conducted a qualitative study to evaluate young female college students' perception of their health status. AlKandari noted that female college students were more stressed than male students and believed that practicing physical activity and eating healthy may help them reduce their stress that, in turn negatively affect their health and related diseases such as cardiovascular disease, being overweight and being obese, and type 2 diabetes.

Western, Peacock, Stathi, and Thompson (2015) conducted a qualitative study to explore the understanding, interpretation and potential utility of personalized physical activity feedback from WFT devices among individuals at future risk of chronic disease. Participants for the study were identified as moderate to high risk for cardiovascular disease and type 2 diabetes and were given a WFT device to be worn for seven consecutive days (Western et al., 2015). Two-hour face-to-face interviews were conducted to better understand views on physical activity and its importance and the comprehension and preferences of the personalized feedback in terms of its motivational properties and practical application. Themes from the data analysis indicated feedback from WFT devices enhanced physical activity knowledge and was motivating to be a potential aide to the self-management of physical activity in individuals at risk for chronic disease.

## Health Issues in Young College Females

### Overweight and Obesity in Young College Females

Young college females are classified as overweight if they have a body mass index (BMI) greater than or equal to 25 and obese if they have a BMI greater than or equal to 30 (Price et al., 2016). Price et al. specified the prevalence of being overweight and being obese is higher among young females who attend college than those who do not. More specifically, they reported that 31.3% of females attending college are overweight or obese. The increase of being overweight and being obese occurs more between the young adult ages of 18-25 years, a life forming period labeled emerging adulthood (Bertz et al., 2015; Mongiello et al., 2016; Price et al., 2016; Torres et al., 2016; Tran & Zimmerman, 2015).

Being overweight and being obese have become a global epidemic and represents a leading public health concern. The greatest increase in rates of being overweight and being obese occur in young adults 18-25 years of age (Odlaug et al., 2015). Odlaug et al. stated that obesity in young college adults is concerning given the numerous health issues and cumulative health risks over time that are associated with obesity. Being overweight and being obese are associated with numerous medical costs and long-term health consequences (Johnson et al., 2016). Downes (2015) reported findings from the National College Health Assessment indicating that 1 in 5 male and female college students, 18-25 years of age, were overweight, and 1 in 10 were obese.

Young adults are at risk for chronic disease as 49 % of this population meets the criteria for being overweight or being obese (Rancourt, Leahey, LaRose, & Crowther, 2015). Rancourt et al. (2015) indicated that, despite the prevalence of health-related issues of being overweight and being obese, this high-risk population participates in inadequate physical activity. They reported that by the year 2020 the global influence of obesity-related chronic diseases will cause up to 73% of deaths and increase disease burden up to 60%.

Being overweight and being obese among college students is related to several factors, including sedentary screen time and fast food obsessions; however, one of the main determinants of being overweight and being obese is physical inactivity (Sa et al., 2016). Odlaug et al. (2015) indicated that 34.1% of college students, 18-25 years of age, are overweight or obese. Sa et al. (2016) reported that physical activity guidelines for college students are 150 minutes of moderate-intensity aerobic activity and muscular strength activities or 75 minutes of vigorous-intensity aerobic activity and muscular strength activity on two or more days per week; with 42% of both male and female college students not engaging in the recommended guidelines. Physical activity is often compromised such that 62% of male and female college students, 18-25 years of age, failed to meet guidelines for moderate or vigorous physical activity, individually, resulting in being overweight or obesity from freshman year to senior year (Mackey et al., 2015). Besides, the weight gain is comparatively rapid, with an average of 7-8 pounds gained in an 8-month period (Mackey et al., 2015).

Sa et al. (2016) suggested that not only regular physical activity but also avoiding calorie-dense foods could improve overweight and obesity in young college students. Young adults tend to eat more sugary foods, consume foods high in saturated fats, eat too little complex carbohydrates and portions that are too large; this affects their physical and psychological health (Martínez Ãlvarez, García Alcón, Villarino Marín, Marrodán Serrano, & Serrano Morago, 2015). Overweight and obesity prevalence has grown faster among young adults than in the general population (Cha, Crowe, Braxter, & Jennings, 2016). Potentially, a reason for this epidemic in young adults is the adoption of a lifestyle behavior different from mature adults (Cha et al., 2016). Young adults consume a meal later at night, due to the fact they stay up late, and tend to engage in late night snacking, creating an unhealthy eating behavior linked to being overweight and being obese (Cha et al., 2016).

The prevalence of general being overweight and being obese is higher in young college females than their male counterparts (Mogre, Nyaba, Aleyira, & Sam, 2015). Mogre et al. reported being overweight and being obese is more likely to be prevalent in female students because male college students engage in more vigorous physical activity and consume more fruits and vegetables. They indicated that female students have more abdominal obesity then male college students. Emotional and social problems are also associated with obesity, with young college females reporting more stress-related symptoms than young college males (Odlaug et al., 2015). Sa et al. (2016) indicated that reducing stress levels can decrease the incidence of being overweight and being obese.

College students represent approximately half of the young adult population in the United States, reportedly one third of 18-25-year-old undergraduates are overweight or obese (Gonzales, Laurent, & Johnson, 2017). Young college students are more vulnerable to weight gain that will continue into older adulthood and lead to chronic disease (Gonzales et al., 2017). College student's express apprehension about the college food environment and meal plan policies that include poor dietary choices. The influence of food choices for young college students that include all-you-can-eat buffets and unhealthy meal plans may contribute to being overweight and being obese (Gonzales et al., 2017).

There are high rates of obesity among young adults in higher education institutions (Murray et al., 2016). Murray et al. (2016) conducted a study to determine whether a group of college students had the knowledge, confidence, and cooking skills to take control of their meal planning. They concluded that young college students lacked the knowledge, and skills, and had inadequate access to health food options, which limits their ability to improve their food behaviors.

Female college students diet more and have more adverse perceptions about nutrition and weight than male college students (Ruhl, Holub, & Dolan, 2016). Female college students have greater interest in nutrition knowledge than male college students (Yahia, Brown, Rapley, & Chung, 2016). Researchers have indicated that unhealthy nutritional behaviors of increased and high-fatty, high-caloric food consumption increases being overweight and obesity in young college females (Johnson et al., 2016; Osborn, Naquin, Gillan, & Bowers, 2016; Rezapour et al., 2016; Yahia et al. 2016). The National College Health Assessment reported the prevalence of obesity for college students at an average of 12.7%, with obesity prevalence in young college females higher than average at 15.2% (Osborn et al., 2016).

Obesity and increased risks of chronic disease is particularly prominent in young college females as lack of parental direction, unhealthy eating habits, physical inactivity, and stress are factors present in college environments (Price, et al., 2016). Nanney et al. (2015) specified weight gain during college years can have irreversible adverse health-related consequences when no action is taken. Young college females significantly eat more fast food, watch more reality television, and sleep less than male college students (Musaiger, Al-Khalifa, & Al-Mannai, 2016).

Young college females are more concerned about their weight than male college students (Bertz, et al., 2015). Bertz et al. (2015) suggested that young college females have more ambition and desire to lose weight than male students, as they perceive their weight status as being overweight when they are at a normal weight and are worried about weight loss to achieve a thin body (Tanenbaum et al., 2015). Tanenbaum et al. (2015) indicated that more than twice the amount of female college students, 29.8%, had engaged in some type of diet program compared to male students.

Risk factors for premature mortality correlates with physical inactivity, poor nutrition, and being overweight (Martínez Ãlvarez et al., 2015). As physical inactivity increases, evidence points to a causal link between physical inactivity and increased noncommunicable diseases, as well as premature mortality (Shuval et al., 2017). Aceijas et al. (2016) stated that eating a good balance of nutritious food and incorporating activity into the lifestyles of young college students can prevent premature mortality. Aceijas et al. also indicated that premature mortality is mainly due to cardiovascular disease, type 2 diabetes, and unhealthy lifestyle behaviors including physical inactivity and poor diet.

Aminisani et al. (2016) stated that unhealthy lifestyles in college students also have a negative impact on morbidity and premature mortality. College students, 18-25 years old, face lifestyle modifications that bring new challenges in both their social and academic environment and some choose adverse health behaviors that continue throughout their adult lives, exposing them to early mortality (Aminisani et al., 2016). Premature mortality risk increases with every 5 kilograms of weight gained during young adulthood (Allman-Farinelli, 2015). To compound the overweight and obesity issue in young adults, the early onset of this health issue and a BMI of 25 or greater may lead to chronic disease, such as type 2 diabetes, cardiovascular disease, stroke and cancer, and an increase in premature mortality (Allman-Farinelli, 2015).

**Type 2 Diabetes in Young College Females**

With the current increase in the rate of obesity in young adults, obesity-related type 2 diabetes will be an additional concern for this population (Amuta, Barry, & McKyer, 2015). Amuta et al. (2015) indicated that there is increased prevalence of type 2 diabetes in the United States in young adults age 18-25 years during the transition from high school to college. While type 2 diabetes has usually manifested in adulthood, incidence rates among younger demographic groups, such as young college adults are rising rapidly (Amuta et al., 2016a). The number of young adults in the United States who are diagnosed with type 2 diabetes is estimated to increase from 22,820 young adults in 2010 to 84,131 young adults in 2050 and stated that 3,600 young adults are newly diagnosed with type 2 diabetes each year (Amuta et al., 2016a). Behavioral risk factors for type 2 diabetes including physical inactivity, poor nutrition, and being overweight or being obese increases as young adults attend college, despite the health consequences of these high-risk behaviors (Amuta et al., 2015; Mongiello et al., 2016).

Currently, in the United States, researchers have stated that there has been a 70% increase in obesity in young adults 18-29 years of age, which parallels a 70% rise in type 2 diabetes in adults under 40 years of age (Amuta et al., 2015; Htike et al., 2016). To compound this issue, Htike et al. stated that type 2 diabetes tends to act more aggressively with an indication of premature micro and macrovascular disease, premature atherosclerotic changes, and cardiovascular diseases in young adults. They indicated that risks of myocardial infarction in young adults with type 2 diabetes is fourteen times higher than those who develop type 2 diabetes in later adult years. They also noted that type 2 diabetes in young adults reduces life expectancy by 15 years and many young adults will have a minimum of one severe complication of the disease before the age of 40. Young adults with type 2 diabetes will also have poorer medical outcomes than older adults with type 2 diabetes (Browne et al., 2015).

Weight gain and obesity during young adulthood among young females is associated with the increase of chronic conditions including type 2 diabetes and cardiovascular disease (Holley, Collins, Morgan, Callister, & Hutchesson, 2016). Mongiello et al. (2016) indicated young college females who are overweight are likely to experience type 2 diabetes at a younger age than any previous generation. Regardless of initial weight, weight gain in young female adults, age 18-24 years, contributes to adverse changes in fasting insulin (Munt, Partridge, & Allman-Farinelli, 2017).

Young college students, age 18-25 years, are forming long-lasting diet and health behaviors related to an increased lifetime risk of type 2 diabetes (Mongiello et al., 2016). Mongiello et al. (2016) suggested that vital characteristics for this life period of young college students is self-awareness, which involves exploring new behaviors related to their health, and an increase in autonomy, making important health-related decisions on their own. They indicated that this timeframe is important for type 2 diabetes prevention strategies as young college students may not recognize the possibility of type 2 diabetes in their future. Their study assessed the personal risk perceptions of college students with multiple risk factors for type 2 diabetes to identify students with an optimistic bias. They reported approximately 39% of students with three or more self-reported risk indicators did not recognize they were more likely to develop type 2 diabetes. They stated 39% of students with several risk factors did not perceive their personal risk for type 2 diabetes to differ from non-risk students. More specifically, 40% of students at high risk for type 2 diabetes believed they would never get the disease. They found that, although family history was a perceived risk for type diabetes, the normal belief that being overweight or obese could lead to the development of type 2 diabetes was not present in the participants. To compound this health-related issue, young female college students have a less optimistic bias about their health related to type 2 diabetes than male students (Mongiello et al, 2016).

The perceptions of the risk for developing type 2 diabetes by young college students is important to better develop type 2 diabetes awareness programs for this population (Reyes-Velázquez & Sealey-Potts, 2015). Reyes-Velázquez and Sealey-Potts

(2015) surveyed 400 college students and concluded that 46.7% did not engage in vigorous physical activity and 16.7% were physically inactive; this is linked to an increase in the possibility of developing type 2 diabetes. Previous researchers have concluded that moderate intensity physical activity significantly or strongly correlated to reduced risk of type 2 diabetes (Amuta et al., 2016b; Htike et al., 2016). Reyes-Velázquez and Sealey-Potts stated that female and male college students differed in levels of risk perception about type 2 diabetes. Female college students have a higher level of risk perception and express greater concern than male college students about their dangers of type 2 diabetes (Reyes-Velázquez & Sealey-Potts, 2015).

Song (2017) conducted a study to determine the medical burdens and predictive factors in young adult onset type 2 diabetes compared with type 1 diabetes. Song stated that the main concern when type 2 diabetes is diagnosed at a young age is the development of complications at an earlier stage of life. Song found that an adverse cardiovascular risk profile was observed among the type 2 diabetes participants with a higher prevalence of obesity, hypertension, dyslipidemia, and clustering of cardiovascular risk factors.

Although type 2 diabetes prevention programs have been implemented in the young adult population, barriers for identifying young adults at risk for type 2 diabetes is difficult as they perceive themselves as healthy, are unaware of their own risk for type 2 diabetes, do not consider being overweight and being obese as a health risk for type 2 diabetes, and rarely take part in diabetes screenings (Yan et al., 2016). Existing diabetes risk-assessment tools have several limitations when applying these to young adults (Yan et al., 2016). Yan et al. stated that limitations include a healthy increase in muscle mass in young adults, referring to this as “healthy overweight.” They suggest this increase in lean tissues can make the BMI an ineffective predictor. They stated a limitation for diabetes risk-assessment for young adults is they can interpret family history of type 2 diabetes differently and unintentionally provide inaccurate responses to a survey. Since type 2 diabetes comorbidities are highly weighted in most existing risk-assessment tools, young adults are most likely not suffering with these conditions at their age, and risk assessments for type 2 diabetes could have unclear definitions of healthy eating and physical inactivity, or lack age-specific considerations. They noted that existing instruments disproportionately factor in age, and do not consider age-related factors.

Mongiello et al. (2016) conducted a study to assess personal risk perceptions of young college students with multiple risk factors for type 2 diabetes. They concluded college students that form long-lasting nutrition and health behaviors with an unrealistic perception of their future lifetime risk of type 2 diabetes. They suggested that young college students represent a largely overlooked group in the fight against a parallel epidemic of obesity and type 2 diabetes. They stated that unrealistic optimism, judging one’s own susceptibility for disease lower than that of other to increase one’s self-esteem, allows this population to maintain their self-esteem by not admitting their lifestyle behaviors of poor diet are adverse enough to make them susceptible to type 2 diabetes.

Type 2 diabetes in young adults place a burden on the economy with increased healthcare costs and increased risk of premature mortality (Reyes-Velázquez and Sealey-Potts, 2015). The burden of type 2 diabetes complications affects both the individual in terms of quality of life, with increased medical costs and society (Funakoshi et al., 2017) as these individuals are predisposed to increased risk of type 2 diabetes health complications during their productive years (Lim et al., 2016). Therefore, type 2 diabetes in young adults has become a critical concern in health and present economies (Yu et al., 2016).

**Hypertension in Young College Females**

Hypertension is a chronic health condition due to the role it plays in the development of non-communicable diseases such as coronary heart disease, stroke and other vascular complications (Nayak, Thakor, & Prajapat, 2016). Hypertension is a major risk factor for cardiovascular mortality, accounting for 20-50% of all deaths (Nayak et al., 2016). Sarpong, Cuury, and Williams (2017) reported cardiovascular disease is the leading cause of mortality in the United States, with medical costs approximately $475.3 billion per year.

Health risks of college students in the United States related to being overweight and being obese are rising (Saleh, Othman, & Omar, 2016) with a substantial increase in the prevalence of cardiovascular risk factors and hypertension (Sarpong et al., 2017). Cardiovascular disease developed during the young adult period is associated not only with additional chronic disease but also with premature mortality (Fontil, Gupta, & Bibbins-Domingo, 2015). Although stroke incidence and mortality has seen a decline in adults, age 55 years and older, in recent years in the United States, stroke incidence has increased in young adults related to the high prevalence of hypertension (Fontil et al. (2015); Swerdel et al. (2016). Fontil et al. suggested that many physicians are reluctant to initiate pharmacotherapy in young adults because of long-term use of medication risks; however, there is a need to address the cardiovascular risk of hypertension that exists in this specific population.

As noted previously, the transition into college for young adult females is linked to an increase in sedentary behaviors, bad eating habits, and being overweight and being obese, all factors associated with cardiovascular risk (Aceijas et al., 2016; Jung et al., 2016; Many et al., 2016; Tran & Zimmerman, 2015; VanKim et al., 2016). In several studies, barriers to the control and management of hypertension in young adults, including healthy lifestyle behaviors adopted during this time period have been assessed (Kernan & Dearborn, 2015; Mitchell et al., 2015). Metabolic syndrome is a complex health issue related to overweight/obesity, type 2 diabetes, and hypertension, and although increasing age has historically been the strongest predictor of metabolic syndrome, up to 17% of young adults 18 to 39 years of age have metabolic syndrome (Many et al., 2016). Lifestyle habits learned by young college females are serious determinants of their future health and cardiovascular risks.

Johnson et al. (2016) conducted a qualitative study on the experiences of young adults to identify hypertension control barriers for effective prevention strategy design. Semistructured interview questions were developed based on previous data on hypertension control barriers and management of cardiovascular risk among young adults. Themes analyzed through thematic analysis included experiences and emotions after a diagnosis of hypertension, attitudes about lifestyle behaviors, medication use, education on hypertension, and social media use of hypertension management and were topics that guided the interviews (Johnson et al., 2016). They concluded that young adults participating in their study emphasized a change in self-identity upon hypertension diagnosis, such as the diagnosis, caused them to feel older than their biological age, and that they experienced adverse psychological effects post-diagnosis.

Characterizations of prevalence of hypertension among young adults 15-24 years of age include being overweight and being obese and high blood pressure (Kim, Lewis, Baur, Macaskill, & Craig, 2017). Kim et al. reported that inadequate levels of physical activity were identified as a risk factor for hypertension in both male and female young adults. They also suggested physical activity educational strategies should be personalized for males and females. Educational programs for males could begin in late adolescence; however, due to young females experiencing early puberty, and hormonal changes, such as insulin resistance, physical activity programs for young females should be more focused on early adolescence. They stated lower levels of physical activity and obesity were associated with the higher prevalence of hypertension among females 15-24 years of age.

Seow et al. (2015) conducted a cross-sectional study to investigate the proportion of young college adults with prehypertension or hypertension and the association of lifestyle behaviors. Seow et al. found that high blood pressure during youth continues into adulthood and cardiovascular disease mortality, with risk beginning at a blood pressure level of 115/75mm Hg is progressively rising. The survey for the study assessed both nutrition and physical activity behaviors including choices for where they eat, how often they make their own food, and frequency and duration of weekly physical activity

(Seow et al., 2015). As a result, they concluded that prehypertension or hypertension may be common in young adults associated with unhealthy modifiable lifestyle habits.

Young adulthood is an age of vulnerability related to lifestyle behaviors associated with hypertension. Nayak et al., (2016) conducted a study to assess the knowledge of young adult college students regarding hypertension and preventative behaviors before and after an educational training intervention. Promoting health education in a college environment is important as college students become increasingly independent in choosing behaviors related to nutrition, physical activity, and health care services (Nayak et al., 2016). Nayak et al. noted that knowledge of the young college student participants regarding normal range of blood pressure increased from baseline by 49% after the intervention, and knowledge regarding risk factors of hypertension increased by 32% post-intervention. They indicated that baseline knowledge regarding preventive measures for hypertension such as healthy eating and physical activity increased by 43% for nutrition and 30% for physical activity. They concluded that college age adults are vulnerable to adopt lifestyle behaviors predisposing them to hypertension. They stated that this period is critical for learning about long-term preventive measures of hypertension, such as healthy eating and physical activity.

College students are faced with newly found health-related responsibilities, such as eating unhealthy foods and being physically inactive, and this situation provides great opportunity for educational strategies related to hypertension (Sarpong et al., 2017). In their study Sarpong et al. measured young college students' knowledge of healthy levels of blood glucose, cholesterol, blood pressure and BMI. They concluded that the level of awareness was exceptionally low for all four indicators. Additionally, less than one in every four young college students knew if the four measured indicators were within the normal range, supporting studies which found young college students have a low risk perception and low knowledge level about hypertension and heart disease compared to other non-communicable diseases (Sarpong et al. 2017). They found that females were more likely to not identify themselves at high risk for hypertension or heart disease. Choices made by young college students place them at risk for hypertension (Mackey et al., 2015). In a recent study to better understand technology-based interventions in young college students, Mackey et al. reported that 21.6% of young college female participants, aged 18 to 20 years old, had blood pressure measurements in the 120-139 mm Hg systolic range, and 5.4% of females had blood pressure measurements higher than normal, placing females in the prehypertension category.

**High Cholesterol in Young College Females**

Cardiovascular disease can be caused by risk factors that can be controlled, including the health issues previously discussed; overweight and obesity, type 2 diabetes, hypertension, and lack of physical activity (Tran & Zimmerman, 2015). Additionally, high cholesterol or even moderate elevations in non-high-density lipoprotein cholesterol, a commonly used marker for a blood lipid pattern associated with increased risk of heart disease (Gao et al., 2017) in young adulthood increased the subsequent risk of future heart disease (Navar-Boggan et al., 2015). Hyperlipidemia, a health condition characterized by elevated plasma lipid levels (Bagchi et al., 2017), has been documented as a modifiable risk factor in the etiology of cardiovascular disease, with elevated lipid profile the main contributor to the development of heart attacks worldwide (Jafri, Qasim, ur Rehman, & Masoud, 2015). Young adults with high low-density lipoprotein cholesterol are 44% more likely to also have high cholesterol into adulthood. Melnyk, Panza, Zaleski, and Taylor (2015) indicated that 1 in 5 young adults have abnormal lipid levels. In their study of knowledge assessment of cardiovascular risk and lifestyle choices among young college students, Melnyk et al. concluded that regardless of education level, 80% of the sampled population self-reported as being sedentary, and less than 20% of college students knew their cholesterol levels.

Tayebi, Mottaghi, Mahmoudi, and Ghanbari-Niaki (2016) conducted a study to examine the effect of a short-term physical activity program involving circuit resistance training on serum lipids in young college female students. They concluded that the most prevalent facts related to high cholesterol are poor nutrition and lack of recommended physical activity. Importantly, their findings should be of concern for this population due to the association between sedentary lifestyles and high cholesterol, and physical activity levels having a dose-response effect on health indicators. They reported that the risk for high cholesterol and cardiovascular disease increases 1.5 times in young adult females who do not meet the recommended levels of physical activity.

Pharmacotherapy guidelines for high cholesterol depends primarily on predicted 10-year risk of cardiovascular disease; thus, physicians tend not to recommend cholesterol-lowering medication for young college adults with high cholesterol unless their cholesterol is extremely high, even though high cholesterol can cause cardiovascular damage during young adulthood (Pletcher, Vittinghoff, Thanataveerat, Bibbins-Domingo,

& Moran, 2016). Pletcher et al. (2016) indicated young adult early life risk factors are associated with the buildup of cholesterol or exposure to hyperlipidemia that will continue into middle and late adulthood and that measuring cholesterol during young adulthood is a means to predict chronic disease later in life.

Healthy eating habits and aerobic fitness activity have a positive effect on blood lipid profiles in young adults, including total body fat and atherosclerosis (Fernström, Fernberg, Eliason, & Hurtig-Wennlöf, 2017). In their study, Fernström et al. measured several health indicators, including high blood pressure, high-density lipids, physical activity, and dietary habits in young college students in relation to cardiovascular disease. They concluded that 34% of the participants who were at-risk for high-density lipoprotein cholesterol had unhealthy eating habits. They indicated that high aerobic fitness is associated with low cardiovascular risk in young adults, and the high prevalence of unfavorable levels of high-density lipoprotein cholesterol raises concerns about the future risk of cardiovascular disease in young adults.

Lee, Lee, and Yeun (2017b) conducted a study on 34 female college students, age 18-20 years, to assess the impact of an intensive 10-day nutrition and physical activity program. Young college females were randomly allocated to either the intervention group or control group. They conducted the study to determine the effects of the program related to blood factors of young college females, including cholesterol. They concluded that when young female college students exercised and ate healthy they reduced their weight and BMI, increased strength and cardiorespiratory endurance, lowered total cholesterol, and reduced low-density lipoprotein cholesterol. Chow et al. (2016) found similar results during twenty weeks of fitness activity with young adult participants: self-monitored physical activity in young adults may lower low-density lipid levels and improve high-density lipid levels.

Jafri et al. (2015) conducted a study to estimate the lipid profile of young male and female college students related to dietary habits. All students participating in the study had their serum lipid levels measured including total cholesterol, low-density lipid cholesterol, high-density lipid cholesterol, and triglycerides. They found that 45.03% of males and 36.84% of the female college student participants showed significantly raised levels of low-density lipids, compared to normal value. They stated that and 25.19% of male college students and 21.05% of college females had significantly higher total cholesterol, compared to standard values. Yan et al. (2016) indicated that standard values related to high total cholesterol in young adults is ≥240 mg/dl, low high-density lipid cholesterol for males <40 mg/dl and females < 50 mg/dl, high low-density lipid cholesterol ≥130 mg/dl and high triglyceride ≥ 150 mg/dl is considered as having metabolic abnormality. Jafri et al. reported 6.8% of college males and 5.26% of college females had elevated triglycerides. They concluded that college students that ate fast food more often, had higher cholesterol compared to those students who ate at home, and that elevated lipid profiles in young college females pose a risk for cardiovascular disease in later adulthood.

There is a high incidence of high cholesterol in young college male and females (Jafri et al., 2015). For predicting coronary heart disease in young college adults, evaluation and prevention strategies of coronary risk and hypercholesterolemia should mainly focus on changeable factors such as physical inactivity, bad eating behaviors, and being overweight and being obese, as these three risk factors are prevalent in this population (Torres et al., 2016). The Framingham Risk equation has established efficacy for coronary heart disease risk prediction among diverse populations; however, age does not contribute substantially to the total score considering young adults have less clinical risk factors (Gibbs, King, Belle, & Jakicic, 2016). Gibbs et al. (2016) suggested that the American Heart Association's Ideal Cardiovascular Health (IDEAL) score, which includes smoking, total cholesterol, fasting glucose, blood pressure, BMI, diet, and physical activity correlate better with cardiovascular health changes in young individuals. The addition of physical activity, BMI, and diet are measures of importance related to high cholesterol in young female students (Gibbs et al., 2016) which the Framingham Risk equation does not measure, indicating the score from IDEAL better reflects the behavior lifestyle of young adults (Torres et al., 2016).

**Stress in Young College Females**

Stress is an inevitable part of the student environment that continues to increase in severity and prevalence in the college age millennial population (Beiter et al., 2015; Holliday et al., 2016). Given the degree of new experiences and new challenges young college students face, this life period can be characterized by considerable stress (Hintz, Frazier, & Meredith, 2015). Homesickness, as students transition away from home, appetite disturbance by making poor food choices, academic pressures, time management, physical inactivity, and poor sleeping habits all correlate with stress and poor health outcomes (Hintz et al., 2015).

One out of every three young college students report levels of stress, or situational events that exceed coping resources (Beiter et al., 2015). Millennial college students as a generational group have the highest levels of stress of any other age group, with 75-80% of this population reporting they are moderately stressed, 10-12% report they are severely stressed, and 39% report that their stress level increase each year of college (Coccia & Darling, 2016). Bamber and Kraenzle Schneider (2016) stated that 53.5% of college students report their stress levels are above average or extreme, 45.1% report their academic schedule causes stress, and 30% reported that stress was an interference in their academic performance. Identifying behaviors that may help young college student reduce the adverse effects of their everyday stress is significant (Flueckiger, Lieb, Meyer, Witthauer, & Mata, 2016).

One method to help college students buffer stress is physical activity (Flueckiger et al., 2016). Flueckiger et al. (2016) investigated stress-buffering behaviors, including physical activity in an intensive longitudinal study over two academic years. They concluded the more physical activity college students performed on a given day, the weaker the association was between stress and the affect it had on the daily lives of college students. The participants stated that when they have an extremely stressful day, increased physical activity may buffer the adverse effects of stress.

There is growing research on the correlation between stress in young college students and obesity risk, as high stress has been linked to weight gain and adiposity, and may potentially hinder positive weight loss (Pelletier, Lytle, & Laska, 2016). Students with higher stress levels engage in more health risk behaviors (Pelletier et al., 2016).

Female college students are more likely to experience greater stress than male college students (Pelletier et al., 2016). The impact of stress on college students, may cause either short-or-long term chronic disease; however, when stress is decreased adverse health conditions also decrease (Rizer et al., 2016).

Physical activity can improve young college students learning abilities and cognition, improve self-concept, reduce stress, improve sleep, and increase concentration and attention span (Al-Drees et al., 2016). However, young college students with high stress levels are likely to fall short of regular exercise (Beiter et al., 2015). Gerber et al. (2017) noted in their study related to physical activity and stress, young college students who had high levels of stress and vigorous physical activity below the recommended standards of less than three times of 20 minutes per week, had less positive mood, lower calmness, and higher stress levels.

Stress can affect young college students' health and nutritional behavior. Papier, Ahmed, Lee, and Wiseman (2015) stated stress can influence the amount and selection of food that college students choose, as they tend to choose and consume high-caloric, high-fat, carbohydrate-dense snack foods when feeling stressed. Increased consumption of chocolate, snack-type foods, sweet snacks, processed foods, and ice cream were choices college students made when under distress (Papier et al., 2015).

## Physical Activity in Young College Females

It is well documented that consistency in regular physical activity decreases the health risk of many chronic diseases and enhances an individual's quality of life (Htike et al., 2016; Kooiman et al., 2015; Sa, Heimdal, Sbrocco, Seo & Nelson, 2016; Sullivan &

Lachman, 2016; Tran & Zimmerman, 2015). Approximately 6 out of 10 college students engaged in less than 3 days per week of vigorous-intensity or moderate-intensity physical activity, collectively making this issue a health-related risk of concern for this young population (Ickes, McMullen, Pflug, & Westgate, 2016). Despite the importance of this health risk, improvements in increasing physical activity in young college students has been minimal, indicating a need for evidence-based interventions focused on physical activity (Ickes et al. 2016).

Young college females report weight loss and body image as key motivators for physical activity, as susceptibility to negative eating and exercise behaviors suggest this young population is vulnerable to obesity and chronic disease (Pellitteri et al., 2017). Physical activity decreases in young females between 18-25 years of age as they enter college (Choi, Chang, & Choi, 2015; Fletcher, 2016). Choi et al. (2015) indicated that young adulthood is when health-related behaviors are established, and these patterns are most likely to continue throughout their lives effecting lifelong health. Physical activity can have an impact on young adults' physical health with prevention of cardiovascular disease, increases in physical strength, raising self-confidence, increasing cognitive awareness, and reducing stress (Molanorouzi et al., 2015).

In their study, Choi et al. (2015) reported female students perceived their weight between moderate and overweight, reported significantly lower perceived health, spent more time sitting than male students, perceived lower physical activity self-efficacy, and lower physical activity outcome expectations and had less physical activity goals than male students. They found that more female students did not meet the recommended amount of physical activity when compared to their male counterparts. They also found that physical activity self-efficacy was a significant predictor of physical activity in male students but not in female students.

Fletcher (2016) noted that physical activity declines with age, with the greatest decreases happening during the college years. Fletcher stated that in both young male and female college students, physical inactivity continued until the age of 29. Bergier, Bergier, and Tsos (2016) conducted a study using the International Physical Activity Questionnaire (IPAQ) and concluded that physical activity is lower among female students than male students. They stated that characteristics of male students and female students differed and may correlate with the amount of physical activity. They indicated that male students are more likely to play sports or work more physical jobs than female students. Price et al. (2016) indicated a decline in physical activity levels among college females is also correlated with their prioritization of social obligations.

Despite the importance of physical activity, female college students do not respond in a positive way to intrinsic motivation, as their male counterparts do; they are more positive to extrinsic motivation, suggesting the importance of body image, beauty, how their clothes fit, mirror reflections, and scale weight (Fletcher, 2016; Lauderdale, Yli-Piipar, Irwn, and Layne, 2015). Lauderdale et al. (2015) reported intrinsically motivated college students are more physically active and have better emotional health compared to college students who are extrinsically motivated. Female college students are more likely to associate physical activity with health status, weight management, and appearance, and male college students are more likely to associate physical activity with fun, challenging, social competition, and strength (Lauderdale 2015). Lauderdale et al. stated female college students are more concerned about calorie intake and find little enjoyment in physical activity.

Typically, female college students engage in more physical activity during the week than on weekend days, although many do not achieve the recommended 10,000 steps per day on either the weekdays or weekends (Clemente, Nikolaidis, Martins, & Mendes, 2016). In comparison, male college students walk more steps, and spend more time in both moderate and vigorous physical activity than female college students (Clemente, et al., 206). Therefore, an emphasis on physical activity interventions should be given to female college students (Lauderdale et al., 2015).

Research indicates physical activity interventions involving young college students can influence attitudes towards physical activity (Esslinger et al., 2016). Esslinger et al. (2016) indicated in a required physical activity and wellness course during tertiary education, college students showed significant improvement in attitude towards physical activity, upon completion. They stated that college students who were required to take health and physical fitness courses showed more positive attitudes than those college students who had no requirements of physical activity courses and were more likely to continue with the physical activity of choice post-graduation.

Generally, females describe their physical activity and nutritional behaviors during college to be unstable (Saaty, Reed, Zhang, & Boylan, 2015). Saaty et al. (2015) reported female college students, 18-25, indicated outcomes of physical activity as being healthy, increasing energy, losing weight, sleeping better, and decreased stress. In addition, female college students do not find much enjoyment in exercising; however, they do like the after-effects of feeling better (Saaty et al., 2015). Most female college students have high intentions of meeting the physical activity recommendations; however, barriers such as time restraints, academic responsibilities, low-motivation, and being uncomfortable in the gym all affect expected adherence.

More females are classified as inadequately active and may have less time for exercise than males (Langdon, Joseph, Kendall, Harris, & Mcmillan, 2016). Furthermore, perceived barriers for young college females are time-effort, defined as physical activity to timely and too hard, lack of social encouragement from friends, disliking physical activity when performed alone, and no interest in engaging in strength training when compared to male students (Langdon et al., 2016). Young college females are more motivated by extrinsic factors such as social interaction to meet new people and body image improvement through physical activity; Langdon et al. (2016) suggested these motives can be beneficial to physical activity adoption.

Ickes et al. (2016) stated when young college students receive educational resources on physical activity they participate more frequently in exercise. They reported the factors that predicted involvement in physical activity in young college females which included self-efficacy and social support, particularly for overweight or obese college females. Ultimately, adherence to physical activity leads to improvements in quality of life and health-related issues in young college females (Al-Eisa et al., 2016). Ickes et al. (2016) noted that when college students are conversant with the benefits of meeting physical activity requirements, they have more positive attitudes toward physical activity, and are much more likely to participate on a regular basis.

Physical activity is a potential mediator for behavioral change including self-efficacy, social support, and positive attitudes to reduce stressors (Al-Drees et al., 2016). In their study, Al-Drees et al. (2016) indicated a significant association was found between a higher GPA and physical activity when young college students performed at least 30 minutes of moderate physical activity 5 days a week, or 20 minutes of vigorous physical activity 3 days a week, than those students that were physically inactive. In addition, Al-Drees et al. stated that perceived barriers for college students to engage in physical activity included lack of time and laziness. Self-efficacy and self-motivation, such as happiness and staying in shape, and social and peer support, were reported to add pleasure to performing physical activity (Al-Drees et al., 2016).

On average, 87% of young college females who adhere to physical activity chose traditional moderate intensity aerobics as this type of activity is a more comfortable approach to exercise (Langdon et al., 2016). Positive results from aerobic activity include changes in body composition, blood pressure, and heart rate among active college females (Langdon et al., 2016). Langdon et al. reported aerobic activity increases body fat oxidation and may help the body use fat for energy instead of stored glycogen, resulting in reduced obesity, and improved insulin sensitivity. They noted that aerobic activity can potentially reduce blood pressure, an important factor in the health of the young female population. They suggested that when young college students who are overweight or obese adhere to continuous physical activity more improvements were seen in cardiovascular functions and increased fatty acid utilization (Langdon et al., 2016).

The incidence of chronic disease in young females between the ages of 18-24 years has increased due to the overall decrease in physical activity (Kim & Han, 2016). Kim and Han (2016) stated that physical inactivity is a critical determinant of being overweight and being obese including disability, discomfort, disfigurement, disease, and death. They indicated that physical activity may potentially improve body composition by lowering body fat and increasing skeletal muscle and maintaining a healthy psychological well-being.

High blood pressure, high cholesterol, unhealthy eating behaviors, being overweight and being obese, and physical inactivity are the most important risk factors for non-communicable diseases in young adults (Al-Nakeeb, Lyons, Dodd, & Al-Nuaim, 2015). Al-Nakeeb et al. (2015) conducted a study to explore health habits and risk factors in young adult college students. The researchers examined the interrelationships of risk factors, such as BMI, physical activity, and perceived barriers of non-participation of exercise in young adults, to provide data on health habits. A validated self-report questionnaire was administered face-to-face by the researchers, with 47 items to assess physical activity patterns, sedentary activities, and dietary behaviors. They concluded the students with the highest BMI reported more sedentary time. They stated barriers to physical activity included both health reasons and lack of time. The student population with the highest risk factors of being overweight and being obese were female students with a mean age of 20.4 years, and reported poor engagement in healthy eating, the highest consumption of unhealthy foods, low physical activity, and the highest BMI.

**Nutrition in Young College Females**

In several studies, it was found that nutrition education on dietary behaviors may change students' food choices; however, results from previous literature have been mixed as some reported that nutrition education has no significant correlation to food choices in young adult college students age 18-25 years (Matthews et al., 2016; Ruhl et al., 2016; Yahia et al., 2016). Yahia et al. indicated that some basic understanding of nutrition is necessary for any type of diet change to occur. As a result of their study to explore if increased dietary knowledge is associated with consumption of less unhealthy saturated fats in young college students they concluded that students with greater nutrition knowledge consumed lower amounts of saturated and cholesterol per day than students with lower nutrition knowledge. They indicated nutrition knowledge is useful in improving nutrition behaviors, and young college students with the necessary nutrition information and skills to make healthy lifestyle changes feel empowered. They also stated that females are more likely to have a greater interest in nutrition and body weight and have a greater nutrition knowledge of the subject than male students. Nutrition knowledge and attitudes should be considered when educating female college students on both nutritional and dietary changes, as attitudes about healthy food choices may improve by understanding the benefits healthy foods offer (Ruhl et al., 2016). Female college students who dieted had a different decision-making process regarding healthy eating;

however, although female dieters ate less unhealthy foods than those females who did not diet, they both consume the same amount of healthy foods (Ruhl et al. 2016).

Most foods consumed by young college students are high in both fat and sugar and do not meet the recommended dietary guidelines (Ruhl et al., 2016). Female college students tend to pay more attention to dieting and have more negative thoughts about their eating habits and weight issues than male college students (Ruhl et al., 2016). The intentions of female college students to eat healthy food may not be strongly related to their attitudes about the nutrient value, necessity, or palatability, as they have a bigger concern with the role food plays in weight gain (Ruhl et al., 2016). As female college students place a strong emphasis on physical appearance related to body image and shape, some young females resort to extreme dieting plans with unhealthy behaviors to lose body fat and weight (Kim & Han, 2016).

Downes (2015) conducted a study to examine the health behaviors of young college students, 18-25 years old, to assess the relationship between perceived motivators and barriers of physical activity and nutrition lifestyles. Downes used the modified Youth Risk Behavior Survey (YRBS) to measure health behaviors and the Motivators and Barriers of Health Behaviors Scale (MABS) to assess factors that facilitate physical activity and healthy eating habits. Downes stated that the recommended dietary guidelines for adults includes consuming 1 ½ to 2 cups of fruit per day and 2 to 3 cups of vegetables per day, along with a reduction of saturated fats, sugars, and refined grains. Downes concluded that one-third of the participants snacked daily, and two-thirds snacked 1-6 times per week. Downes suggested that snacking is related to low self-control, lack of nutrition education, low-socioeconomics, and health issues related to food. Downes stated that young college students with more barriers are likely to practice unhealthy behaviors including snacking on chips, cookies, cupcakes, and ice cream; foods that are high in calories and have little nutrient value. In addition, female students eat an abundance of high-calorie foods and beverages that are high in sodium, which can lead to prehypertension or hypertension (Matthews et al., 2016)

The eating habits of young college adults can be influenced by many factors, including cost, taste, convenience, and over indulging in unhealthy snacks (Ruggeri & Seguin, 2016). Ruggeri and Serguin (2016) examined current eating and physical activity behaviors in young college students along with awareness of point-of-selection nutritional information. Even though the dining hall displayed nutritional information for all entrees over half of the students stated they didn't even know it was posted. Similarly, even students that lived in the dorms and had access to the dining hall ate at fast food establishments on average of 4.21 times per week. Additionally, 67% of college students ate fast food out of convenience, 36% reported they prepared no at-home meals, and 51% reported that although they were unaware of the nutritional information at point-of-selection, the information was irrelevant (Ruggeri & Serguin, 2016).

Osborn et al. (2016) found that weight dissatisfaction is more prevalent in females than in males; 50.1% in females and 35.1% in male's due to the fact that females perceive their ideal body weight should be lower than males. They noted that weight satisfaction and perceived body weight in female college students was shown to have a direct impact and significant prediction on their healthy eating behaviors. In their study, Osborn et al.

described 67% of young college students reported eating fruit less than one time per day, 83% of college students ate green vegetables less than one time per day, 71% of college students ate other vegetables less than one time per day, 22% reported drinking colas at least once per day, and 53% of college students ate breakfast fewer than four days per week. Over 50% of all female college students who are overweight or obese report they are currently on some type of dietary plan or have been on a restricted nutritional program while attending college (Arouchon, Rubino, & Edelstein, 2016). Thus, Matthews et al. (2016) specified 60% of young college students have an interest in nutrition education at their institution, with subjects that include meal planning, understanding how to make food shopping lists, and calculating calories to improve their self-efficacy.

In a study to assess nutritional behaviors, knowledge, beliefs, and weight status among college students, Yahia, Wang, Rapley, and Dey (2016) found that the mean body fat percentage for all participants was 25.8 kg/m2, which is overweight according to the National Institutes of Health (NIH). They concluded that females had a higher body fat percentage than male students, although 78% of the female students were within a healthy BMI range, and 22% were overweight or obese. Nutrition behaviors including intake of protein, a necessary macronutrient to build lean tissue was considerably low in female students with only 24% reporting daily intake of meat, fish, eggs, and dairy (Yahia, Wang et al., 2016). Females reported more frequent consumption of sweets than male participants (Yahia, Wang et al., 2016). They concluded nutrition knowledge of healthy and unhealthy dietary habits and physical activity for both male and female college students needed improvement.

Nutritional consumption during young adulthood supports physical health, affects risk of future disease, and plays a part in the prevention of being overweight and being obese (Hong, Shepanski, & Gaylis, 2016). To compound this issue, food choices for students is limited, demonstrated by data from the 2012 American College Health Association-National College Health Assessment (ACHA-NCHA), as a mere 5.3% of college students met the daily intake for essential nutrients (Hong et al., 2016). Young college students that have low fruit and vegetable intake, indulge in high-calorie sweets, and foods high in saturated fats, have higher BMIs, which have a strong risk-association of chronic diseases in later adulthood (Hong et al., 2016). Millennial college students have higher rates of obesity than any other previous generation, as one-third of this cohort of young adults have poor eating habits that contribute significantly to being overweight and being obese (Bryan, 2016). Young college adults may experience a shorter lifecycle than their parents, and it will be the first time ever this has occurred in American history (Bryan, 2016).

## Summary

Young college female students have sedentary behaviors and poor eating habits that may lead to poor health outcomes (Many et al., 2016; Melnyk et al., 2015; Odlaug et al., 2015). Thirty-one percent of the female college students are overweight or obese (Price et al., 2016). Numerous studies have reported high incidence of being overweight and being obese in young female college students (Arouchon et al., 2016; Gonzales et al., 2017; Langdon et al., 2016; Mongiello et al., 2016; Yahia et al., 2016). Physical inactivity and unhealthy eating can increase the prevalence of chronic diseases in this young population, including type 2 diabetes, hypertension, high cholesterol, and stress (Jung et al., 2016). Prevention strategies aimed towards the prevention of being overweight and being obese and other chronic disease needs to be effective and innovative to reduce health inequalities in the millennial population. Research studies for young female college students should be designed to engage this generation in a familiar and comfortable environment. Thus, technology-based interventions, such as the use of WFT, is a potential and effective approach for young college females related to physical activity and nutrition behaviors (Mackey et al., 2015).

WFT offers a range of uses, such as monitoring steps, floors climbed, calories burned, sleep monitoring, weight, inactivity, social connections for uploading data to a cloud-based system, access to daily charts with data synching capabilities, food consumption, and personal weight loss goals (Fotopoulou & O' Riordan, 2017) and food intake at bite level (Salley et al., 2016). Some research has been conducted such as validity and reliability of WFT (Alharbi et al., 2016; An et al., 2017; Chow et al., 2017; Chowdhury et al., 2017; Huang et al., 2016; O'Connell et al., 2016; Reid et al., 2017); convenience and usefulness (Chuah et al., 2016: Gao et al., 2015; Kaewhannate & Kim, 2016); adherence, adoption, and necessary continual use (Cadmus-Bertram et al., 2015; Canhoto & Arp, 2016); comparison of efficiency of different WFT brands (Kaewkannate & Kim, 2016); and the use of WFT to motivate young adults to increase physical activity (Bice, et al, 2016). WFT will be a data collection method of interest in public health research, as they device offers new opportunities for measuring real-time data on physical activity and nutrition behaviors in young female students (Rosenberger et al., 2106).

This research addressed a gap regarding the qualitative characteristics of the user (Bergier et al. 2016; Mongiello et al., 2016) and the experience of the use of WFT by young college females (Chung et al., 2017). Chapter 2 provided a detailed literature search review related to the key strategies for the qualitative study on young college females. Chapter 3 includes the research design and rationale for the study, role of the researcher, methodology section, issues of trustworthiness, ethical procedures, and a summary of the main points of the chapter.

# Chapter 3: Research Method

## Introduction

The purpose of this study was to examine the lived experiences of young female college students and their intent for behavior change and the use of WFT. Although behavioral changes using WFT have been examined in previous studies, most researchers cluster female and male participants in one homogenous group (Colgan et al., 2016; Jakicic et al., 2016; Rupp et al., 2016; Stephens et al., 2015). Additionally, female college students have different characteristics and opinions about their health than their male counterparts (Colgan et al., 2016).

In this chapter, I describe the research design and rationale for why this design was chosen. I also discuss information related to the role of the researcher. The methodology section includes the logic for participant recruitment, the criteria for participant recruitment, how each participant is known to meet these criteria, number of participants, data saturation, and sample size. The instrumentation section includes the data collection instrument, interview protocol, the procedure for the informal field testing, and the procedures for recruitment and data collection. The data analysis section includes the connection of data to the research questions, type and procedure for coding, and the computer analysis software. Issues of trustworthiness are discussed in this chapter including credibility, triangulation, member checking, saturation, and reflexivity. Additional issues of trustworthiness such as transferability, dependability, and confirmability are also discussed. The chapter continues with a discussion on ethical procedures, such as the treatment of participants, approvals from the IRB, ethical concerns related to recruitment materials, data collection, treatment of data, confidentiality, and conflicts of interest. The chapter ends with an overall summary.

Studies have shown that college-age females have increased health risks due to their health-related behaviors. Many et al. (2016) posited that young college females acquire sedentary behaviors as they enter the period of college independence. Several studies suggest young college females, 18-25 years of age, fall short of the recommended amount of physical activity and eat an unbalanced diet, which increases their susceptibility to poor health outcomes (Aceijas et al., 2016; Colby et al., 2017; VanKim et al., 2016). Thirty-one percent of young college females are overweight or obese as the millennial generation reports a decline in both physical activity and healthy eating behaviors (Price et al., 2016). Jung et al. (2016) stated physical inactivity by this population can increase prevalence of being overweight or being obese, hypertension, type 2 diabetes, and adverse lipids. Simpson and Mazzeo (2017) reported that young college adults, ages 18 to 29, were more likely than younger or older individuals to use WFT, and young adult females were more likely to use WFT devices than young males.

In this study the focus was on female college students, specifically the lived experiences of female college students, age 18-25, and their intent for behavior change with the use of WFT. Understanding female college students' lived experiences of intent for behavior change with the use of WFT is essential for reducing the health disparities in this population.

## Research Questions

The study was guided by three research questions.

Research Question 1: What is the intent of young female college students with the use of WFT?

Research Question 2: What are young college female college students' experiences with the use of WFT?

Research Question 3: What are the lived experiences of WFT use by young female college students and their intent for behavior change?

**Research Design and Rationale**

The purpose of qualitative research was to provide rich descriptions about the phenomena under study as they occur in their natural environment (Jones, 2005; Sousa, 2014). Sousa (2014) indicated that qualitative research does not start with a previously determined theory and is based on data; therefore, qualitative research is inductive, exploratory, descriptive, and interpretative. Qualitative approaches are similar in their goal, as the intent is to gain an understanding of a specific phenomenon from the experiences of the individuals experiencing it (Vaismoradi, Turunen, & Bondas, 2013). When researchers are choosing a qualitative approach, they need to determine which qualitative approach can best answer their research questions (Vaismoradi et al., 2013). The characteristics of qualitative methodologies are identifying an approach to an in-depth understanding of a phenomena, committing to the viewpoints of participants, conducting research with the minimum disruption to the natural context of the phenomenon, and reporting findings in a text style rich in participant comments (Vaismoradi et al., 2013). To explore the lived experiences of female college students and their use of WFT, I used a phenomenological qualitative approach.

The purpose of a phenomenological study is to describe the common meanings for individuals of their lived experiences of a concept or phenomenon (Patton, 2015). A researcher conducts a phenomenological inquiry to reduce individual lived experiences to a description of the universal essence (Creswell, 2013). Data are collected by the inquirer from participants who have experienced the phenomenon under study and a thematic description is then developed by the researcher consisting of what and how the individuals experienced it (Creswell, 2013). Phenomenology can be described as an approach to see and articulate without misrepresentation, the intrinsic logic of human experiences, and to understand a phenomenon in terms of causal experiences (Moustakas, 1994).

The phenomenological approach is a philosophical tradition that was first applied to social science to study how people describe experiences through their senses by the German philosopher Edmund H. Husserl (Patton, 2015). Husserl developed the phenomenology research process to define a philosophical method that would provide insight into the experiences of conscious objects (Christensen, Welch, & Barr, 2017). The focus for Husserl was to study a phenomenon as it appeared through consciousness (Laverty, 2003) to capture the essence, the reliable attentiveness to participants' words, descriptions, and phrases (Sohn, Thomas, Greenberg, & Pollio, 2017) and intentionality—the human mind's ability to refer to objects outside of itself (Laverty, 2003). Tuohy, Cooney, Dowling, Murphy, and Sixsmith (2013) described intentionality as "the idea that every thought is a thought of something, every desire is a desire of something, every judgement is an acceptance or rejection of something" (p. 6).

Philosophies also underlying phenomenological research approaches were developed by philosophers Heidegger and Merleau-Ponty and were focused on disclosing the phenomenon in consciousness, the world of lived experiences, and the essence of a meaningful experience (Willis, Sullivan-Bolyai, Knafl, & Cohen, 2016). Giorgi (1997) stated that qualitative phenomenology is used to thematize the phenomenon of consciousness and refers to the lived experiences of individuals. Giorgi indicated that phenomenology researchers either acknowledge the presence or role of consciousness or it will make its presence felt nevertheless. Therefore, it is more rigorous to acknowledge the role of consciousness and the precise meaning of the world than it is to not. A Heideggerian phenomenological approach is when researchers bring their own experience and understanding into the research process, as Heidegger believed that it was not possible to separate the researcher's beliefs from the study (Doody & Doody, 2015). Merleau-Ponty defined phenomenology as a way of thinking about experiences in time, space, and the world in them, rather than using an abstract sense to theorize them (Stolz, 2015).

Phenomenology starts with a double insight: human experience is meaningful to those who live it prior to both interpretation and theory, and the sense of human experience is an inherent physical property of the experience itself (Dukes, 1984). Essentially, there are two phenomenological approaches: descriptive and interpretive. Descriptive or transcendental phenomenology involves the researcher achieving transcendental subjectivity (Lopez & Willis, 2004). Transcendental subjectivity is when the inquirer neutralizes biases and preconceptions, so they do not affect the object of the study to better understand the pure description of the experiences of an individual (Lopez & Willis, 2004; Matua & Van Der Wal, 2015). Willis et al. (2016) defined descriptive phenomenological studies as the researcher adopting the view that individuals live through life events shaped and held within their consciousness with the ability to reflect on their subjective experience. The aim of descriptive phenomenology is to describe the general characteristics and essence of the phenomena as they appear to consciousness (Tuohy et al., 2013). To determine the essence of the phenomenon researchers must put aside inessential factors such as religious or cultural thoughts that can influence how phenomena are understood (Tuhoy et al., 2013).

Researchers who choose descriptive phenomenology use bracketing, which involves suspending ideas, biases, and personal knowledge before proceeding with the experiences of others (Creswell, 2013, Lopez & Willis, 2004). The desire for scientific rigor motivates the use of bracketing by researchers who use descriptive phenomenology (Lopez & Willis, 2004). Husserl believed that conscious experiences have intentionality and to identify the phenomenological essence, the researcher must use bracketing to transcend subjective experiences, theories, and beliefs to objectively describe the phenomenon (Christensen et al., 2017). It is the essence that allows the researcher to be open to the conscious experience of the participant; therefore, bracketing by the researcher does not propose to change the individual's lived experience but to simply see it from a new perspective (Christensen et al., 2017). The research questions related to the phenomenon and identifying a gap in the literature determined the need for a descriptive phenomenological qualitative research framework. The phenomenological approach and qualitative description provided me with a method to describe the lived experiences of young college females related to their intent for behavior change with the use of WFT.

The second phenomenological approach is interpretive or hermeneutic phenomenology, which is oriented toward lived experiences and interpreting the "texts" of life (Creswell, 2013). Tuohy et al. (2013) stated that the purpose of interpretive phenomenology is to describe, interpret, and understand the individuals' experiences. Interpretive or hermeneutic phenomenology is concerned with the world of human experience as it is lived with a focus toward illuminating aspects within the experience to create meaning and understanding and highlight the interpretation of the experience (Laverty, 2003; Matua & Van Der Wal, 2015). Touhy et al. specified the importance of bracketing by researchers as they need to bring it to the forefront to recognize their influences and biases. They suggested that reduction or bracketing is relevant in interpretive phenomenology because no one can avoid being influenced by these factors. Through this acknowledgement, researchers can be open to the meanings of people's lived experiences (Tuhou et al., 2013). There are other qualitative approaches such as narrative, one individual telling his or her lived story; grounded theory, moving beyond description and generating a theory; ethnography, studying a cultural group using observations; and case study, examining one or more cases (Patton, 2015). However, as described, the best approach for this study was the descriptive phenomenological approach.

The researcher needs to determine which approach to use that will best answer the research questions (Creswell, 2013). The phenomenological approach is used when the researcher wants to capture the essence of the lived experiences of individuals who share a common phenomenon (Creswell, 2013). For this study, the purpose of the research questions was to seek to capture the lived experiences of young college females and their intent for behavior change with the use of WFT. The participants were recruited because they shared the same phenomenon of the use of WFT. Therefore, a descriptive phenomenological approach was used.

In a descriptive phenomenological qualitative study, the researcher's intention is to develop new understandings of the lived experiences of individuals relying on first person accounts obtained through observation or participant interviews (Greenfield et al., 2016; Gentles, Charles, Ploeg, & McKibbon, 2015). Interviews remain the most common form of qualitative inquiry in health science research (Morgan, Pullon, Macdonald, McKinlay, & Gray (2017), with semistructured and unstructured interview formats predominating (Elliott & Timulak, 2005). A semistructured interview approach with open-ended questions to guide the in-depth interviews related to the phenomenon was used as the instrument and researcher for the study on young college females and their use of WFT (see Quick & Hall, 2015). The advantage of the semistructured interview method is that it enables mutuality between the interviewer and participant, which enables the interviewer to improvise follow-up questions from the responses of the participants (Kallio, Pietilä, Johnson, & Kangasniemi, 2016).

Once data are collected in a phenomenological study, a systematic analysis involves coding the information and developing themes (Quick & Hall, 2015). Moreover, analyzing qualitative data involves the researcher reading through collected data and identifying patterns, words, and phrases of commonality amongst the participants, which are then coded into themes (Patton, 2015).

## Role of the Researcher

In qualitative research, the nature of the research lens plays an important role because qualitative methods depend on the researcher acting as the instrument for collecting and analyzing data (Sanjari, Bahramnezhad, Fomani, Shoghi, & Cheraghi, 2014; Yin, 2015). Sanjari et al. (2014) indicated that in qualitative inquiries, the researcher is involved in all stages of the study including participant recruitment, interviewing, transcribing data, data analysis, and verifying and reporting themes. As the key instrument, the researcher can collect data through document analysis, observing behavior, or interviewing participants (Creswell & Poth, 2017; Kitto, Chesters & Grbich, 2008). The data are used to gain access to the insights of the research participants and help the researcher develop an understanding of the in-depth meaning that people attribute to their experiences of a phenomenon (Sutton & Austin, 2015). The researcher uses the phenomenological approach for the opportunity to understand the subjective lived experiences of participants (Sutton & Austin, 2015). Equally, in this study my role as the investigator was to recruit participants; collect, interpret, and analyze data from participants; and report these findings.

The qualitative researcher is aware of the socially constructed nature of reality and is rooted closely in the context of the study, including the research environment, participants, data collection, and the central phenomenon (Yates & Leggett, 2016). The qualitative researcher is a reflexive practitioner, aware of his or her own political and cultural perspective yet is willing to engage in self-questioning and self-understanding (Yates & Leggett, 2016). Qualitative methodology requires the researcher to have sensitive interpretive skills and creative talents (Van Manen, 2016).

The researcher conducts interviews that involve in-depth probing and questioning that is responsive to participants and the context of their individual experiences (Ritchie, Lewis, Nicholls, & Ormston, 2013). Ritchie et al. (2013) indicated that the researcher generally adopts a neutral and objective role. For the study on WFT and young college females, I conducted face-to-face interviews. Once participants were recruited, interviews were held at my office in the small city in northern West Virginia. My office is located approximately one mile from all campuses in the area. There is a local bus line that runs directly in front of my office complex that is free to students to ride, which made travel easier for participants. The office complex also has a large free parking lot for participants who have their own transportation.

Once the interview guide was field-tested, the amount of time needed for each interview was determined. Kallio et al. (2016) described field-testing as a technique simulating the real interview situation where the preliminary interview guide designed by the researcher is tested with friends or family. Field-testing provided information about the implementation of the interviews, assured intelligibility, if questions were relevant, whether the questions elicited the experiences of the participants, if the order of the questions were correct, and to assess follow-up questions (Kallio et al., 2016). The order of the interview questions was progressive and logical. The first part of the interview was used to create a relaxed environment in which the participants felt comfortable by asking familiar, lighter questions. Following these lighter questions, the main questions pertained to participants describing as detailed as possible their experiences with the phenomenon, what situations have influenced their experiences of the phenomenon were conducted, and the remainder of the questions followed the response of the interviewee (see Creswell, 2013; see Englander, 2012).

The output of the interview is a verbal account or description by the participant of their knowledge and experiences related to the topic of study (Lopez & Willis, 2004). Each interview is unique, as the researcher uses an open-ended strategy adapted to each participant's experiences and abilities to communicate those experiences (Lopex & Willis, 2004). Participants in qualitative studies have characterized interviews as empowering, liberating, increasing self-awareness, contributing to a sense of purpose, beneficial, and appreciating the opportunity to tell their experiences (Wolgemuth et al., 2015). Researchers must conduct the interviews within an environment of safety and trust and maintain this throughout the study (Laverty, 2003). The researcher will continue to engage in interviews with participants until they believe they have reached a richer understanding of the experience and point of saturation.

The role of the researcher is an important part of the study; however, challenges for novice researchers are the assumption that they have no bias in their data collection and that they may not recognize data saturation (Fusch & Ness, 2015). The researcher must remember that there is both intentional and unintentional bias in all social research by both the participants and the researcher and it is imperative that the interpretation of the phenomena represent that of the participants of the study and not the researcher

(Fusch & Ness, 2015). Clarifying and addressing any researcher bias was essential to assure the study results were valid and reliable. Working in the fitness and nutrition industry for thirty years, provided me with prior knowledge of physical activity, WFT, and healthy behavior change to reduce being overweight or being obese and chronic disease. My previous experiences were mentioned to each participant at the start of the interview. Identifying any preconceived ideas and temporarily suspending any personal biases, beliefs, and assumptions in advance about the phenomenon allowed me to focus on the experiences of the participants with an open mind (Katsirikou & Lin, 2017).

Data collection should be clearly focused on addressing the research questions until the point at which the data no longer reveal new patterns, themes or findings, or data are not enriching the thickness of the lived experiences (Twining, Heller, Nussbaum, & Tsai, 2017). Twining et al. noted researchers need to collect and analyze data concurrently and iteratively to interrogate what they see and hear in the moment. The better that researchers can recognize their personal view of the world and to discern the presence of a personal lens, the better they are able to hear and interpret the behavior and reflections of others (Fusch & Ness, 2015). As the researcher for this study, verbatim participant responses to reduce researcher bias were used.

A guide that outlines the script for interviews including an introduction, consent process, demographic questions, main interview questions, probes, a review process and conclusion should be formatted by the researcher to assure consistency in the interview process (Goodell, Stage, & Cooke, 2016). Goodell et al. stated the researcher can use member checking, a technique in which the interviewer asks participants to review, correct, and confirm the summary of the data. They noted this technique can be used during data collection or data analysis to improve the trustworthiness of the findings.

Taking field notes provide important context to the interpretation of the audio-taped data and remind the inquirer of significant constructs during data analysis (Sutton & Austin, 2015). Field notes are researchers' private, personal thoughts, ideas, and questions about their research interviews (Phillippi & Lauderdale, 2017). Phillippi and Lauderdale stated that at one time these notes had no place in qualitative analysis and remained private; however, researchers now use field notes as they provide necessary information and is an essential component of rigorous qualitative research. They suggest field notes aid in building thick, rich descriptions of the study context, meeting, and interview. Field notes should be secured and maintained in the same manner as transcripts and audiotapes due to their sensitive data and relevance to the study (Sutton & Austin, 2015).

Memoing is a term that refers to any writings that a researcher does in relationship to the research other than actual field notes, transcription, or coding (Maxwell, 2013). These memos are created by the researcher to capture the personal feelings, thoughts, or biases underlying hidden meaning of the data, can be used throughout the study and included in the data when synthesizing the findings (Birks, Chapman, & Francis, 2008; Goodell et al., 2016). Birks et al. (2008) indicated that although memoing is most commonly associated with grounded theory, all qualitative approaches can be enhanced by researcher memoing, and many researchers fail to take advantage of the use of this valuable tool. Memos can range from a brief comment on an interview transcript to a theoretical idea recorded in a field journal and stated that when thoughts are recorded in memos, the researcher can code and develop their ideas further (Maxwell, 2013). Qualitative researchers routinely engage in one or more measures to demonstrate their study is credible, valid, and has trustworthiness including member checking, memoing, thick description, triangulation, peer reviews, and external audits (Twining et al., 2013).

The researcher must be reflexive before and during the research process to provide context and understanding for the readers (Sutton & Austin, 2015). Reflexivity is used by the researcher to make clear their position on world views, perspectives, and biases related to the phenomenon (Sutton & Austin, 2015). Sutton and Austin stated this allows the reader to better understand the filters through which questions were asked, data were gathered and analyzed, and findings were reported. For the study on young female college students and their intent for behavior change with the use of WFT, memoing and optional member checking were used.

## Methodology

### Participant Recruitment

Participants for research studies are generally selected based on criteria rather than those who meet statistical requirements (Laverty, 2003). Laverty stated in descriptive phenomenological inquiries, the aim of the researcher is to include participants who have experience in the focus of the study, are enthusiastic to talk about their experience, and are diverse enough to generate rich and unique stories. In a descriptive phenomenological qualitative study, participants are recruited to add important contributions to the structure and character of the experience under investigation (Sousa, 2014). Participants for the qualitative study on young college females and their intent for behavior change with the use of WFT met the following criteria: 18-25 years of age, female, attending a college or university in a small city in northern West Virginia, currently wearing and using the WFT for a minimum of 6 months to track daily physical activity and nutrition data, syncing collected data to a smartphone or computer, and were willing to participate in an interview to talk about these experiences.

## Sampling Strategy

In a phenomenological qualitative study, it is essential that all participants have experience in the phenomenon being studied and the sampling strategy is appropriate for the research paradigm (Creswell, 2013; Leung, 2015). Qualitative sampling, including its characteristics, recruitment method, relevance of method, and originality should be described clearly (Santiago-Delefosse, Gavin, Bruchez, Roux, & Stephen, 2016). For the study of young college females and their use of WFT a purposive sampling approach was used. Purposive sampling is used for the selection and identification of information-rich cases (Palinkas et al., 2013).

Selecting information-rich cases is the core of purposive sampling (Duan, Bhaumik, Palinkas, & Hoagwood, 2015). Criterion sampling is the most commonly used purposive sampling strategy (Palinkas et al. 2015) and works well when all participants represent individuals who have experienced the phenomenon (Creswell, 2013). In a purposive sample, participants are chosen according to a specific criterion, as they will have greater knowledge of the phenomena under study (Guest, Bunce, & Johnson, 2006;

Palinkas et al., 2015). Participants must be willing to participate and be able to communicate experiences and opinions in a clear, communicative, and reflective manner (Palinkas et al., 2015).

Several studies have used a purposive sampling strategy for young college females. In a study conducted by Sharma, Thomas, and Shrivastav, (2016) a purposive sampling method was used to select young college females 18 to 22 years old who met the sample criteria for their study. Sharma et al. stated the purposive sampling allowed them to recruit participants who had experiences in nutrition knowledge of fruit and vegetable consumption and were pursuing a college science course. They indicated that purposive sampling was successfully used to select information-rich participants who added rich texts to the phenomena of their study.

Woodruff et al. (2017) conducted a qualitative study to explore how young adult females feel about their weight, what weight-related information they had received, and their concerns about future weight gain. Woodruff et al. used a purposive sampling strategy to recruit participants who met the criteria which included young adult college females, 20 to 29 years of age who reside outside a dormitory setting. The purposive sample successfully allowed the authors to recruit the desired population. They concluded that young adult women are concerned about their weight, have received advice on weight loss from social media and primary care providers, and they are concerned about their weight for reasons such as long-term health-related consequences of weight gain, and short-term social consequences of weight gain, including clothes not fitting and negative feeling when shopping for clothes.

The justification of the nonprobability purposive sampling for the study was that this sampling method allowed me to gather and include appropriate participants. Etikan, Musa, and Alkassim (2016) posited that the purposive sampling method is not a set number of participants and that this method allows researchers to choose participants purposely due to their qualities. Eitkan et al. also described that in a purposive sample the researcher decides what phenomena needs to be known and then identifies and selects participants who are well-informed, available, willing, and able to participate and communicate these opinions expressively, reflectively, and coherently. As the purpose of this study is to better understand the lived experiences of young college females and their use of WFT, the purposive sampling strategy was appropriate.

**Sample Size**

The sample size used in qualitative studies is influenced by practical and theoretical considerations (Robinson, 2014). Robinson indicated the real-world reality of research is that most studies require a provisional decision on sample size at the initial stage of the study; however, a priori sample specification can still be flexible. Santiago-Delefosse et al. (2016) stated the sample should be broad enough to capture the many aspects of the phenomenon and the strategy should include a basis for the why this sample was selected, a description of how the sample was selected, and a discussion of how participants were approached. Robinson (2014) suggested that instead of a fixed number, a minimum and maximum range can be given for an estimated sample size. Therefore, qualitative sampling is not a single planning decision, it is an iterative sequence of decisions throughout the course of the research study (Guetterman, 2015).

An additional sampling strategy for the study of young college females and the use of WFT was snowball sampling. Snowball sampling is a purposive nonprobability approach used in qualitative studies when the study is explorative in nature (Deliens et al., 2015). Because the study will be using Facebook for recruitment, the snowball recruitment method aligned with how young college students characteristically communicate and share information (Vandelanotte et al., 2015). Snowball sampling allowed participants who met the criteria to recruit other eligible participants (Spence, Lachlan, & Rainear, 2016). Spence et al. stated that social media recruiting methods are beneficial in their capacity for generating snowball samples. They indicated that the use of snowball samples can reduce time, generate data quickly, and is cost efficient.

Because qualitative research has an ontological and epistemological stance, the sample is not considered to be representative of the entire population nor can the findings of the sample be generalized beyond the study (Twining et al., 2017). Twining (2017) noted for this reason sample sizes are much smaller in qualitative studies than in quantitative studies. Creswell (2013) indicated for a qualitative study it is recommended that the inquirer interview 5 to 25 participants. Cleary, Horsfall, and Hayter (2014) noted that the adequate number of participants involves accurate decision-making by the researcher, as not enough participants may risk adequate depth and breadth; however, too many participants my supply a large volume of data non-conducive to the data analysis.

Factors that influence sample sizes for qualitative studies include the purpose and design of the study, characteristics of the participants, data analysis approach, and resources; however, the most common indicator for an effective sample size in a purposive sample is saturation (Hennink, Kaiser, & Marconi, 2017). Hennink et al. stated saturation is the point at which the iterative process of sampling, collecting and analyzing additional data about a phenomenon reveals no new information. Therefore, data saturation is the point in data collection when the researcher cannot identify any new concept or theme, when data becomes repetitive, and data collection becomes unessential (Cleary et al., 2014; Hennin et al., 2017; Kitto et al., 2008).

Morse (2015) posited saturation is the researcher building rich data within the study by attending to the theoretical aspects of inquiry, including scope and replication. Morse defined scope as exploring both the comprehensiveness and the depth of the phenomena, and that even unimportant and less relevant data require attention as the researcher may unexpectedly realize the importance and significance of this information later in the study. Morse stated replication is when data from several participants have common characteristics. Saturation is first facilitated by sampling, and as qualitative samples are small, it is essential the sample is adequate and that participants are experts in the studies phenomenon of interest. For the qualitative study on young college females and their experiences of the use of WFT, 10 participants were recruited which allowed me to reach saturation.

**Recruitment of Participants**

In qualitative research, selection criteria for participants, such as age, gender, and lived experiences are chosen by the researcher to obtain information related to the phenomenon of the study (Patton, 2015). Kristensen and Ravn (2015) noted that once selection criteria are clear, researchers need to identify the research environment and their method for recruiting participants. Potential participants must be identified, approached, and motivated to participate by the researcher (Kristensin & Ravn, 2015). Kristensen and Ravn suggest there are numerous ways to contact potential participants, such as written advertisements on Facebook and Twitter, dissemination of brochures in public places such as coffee shops and bookstores, and posting flyers at schools and universities, and in neighborhood gathering places, such as community buildings and churches.

Recruiting young college adults for health-based research has long been a challenge as barriers including student schedules, lack of transportation to research sites, and lack of interest that hinder the recruitment process (Fazzino, Rose, Pollack, & Helzer, 2015). Recruiting an adequate number of participants can be difficult for many researchers; however, the use of social media has prompted a new method of gaining access to the public (Carter-Harris et al., 2016; Topolovec-Vranic & Natarajan, 2016). Health researchers have found that social network sites are valuable approaches when recruiting participants for health science studies (Bender, Cyr, Arbuckle, & Ferris, 2017; Gelinas et al., 2017; Sikkens, van San, Sieckelinck, Boeije, & de Winter, 2017).

Facebook is a viable research platform that offers numerous advantages over traditional methods, including a large user base which supplies a huge pool of potential participants, user sharing for snowball sampling, recruitment, and the ability for researchers to import users' profiles containing demographics, interests, and social network data (Bender, et al., 2017; Rife, Cate, Kosinski, & Stillwell, 2016). These social networks are flexible enough for the researcher to control and evaluate the recruitment efforts, are cost-effective, and reduce time and effort compared to traditional recruitment approaches (Bender et al. 2017; Carter-Harris, Ellis, Warrick, & Rawl, 2016). Motoki et al. (2017) indicated that social media such as Facebook is a promising way to reach young adults as it is one of the most prevalent social networking sites worldwide and is one of the most popular social networking sites used by young college females to communicate. Fazzino et al. (2015) stated that 93% to 99% of students use Facebook, and 57% use more than one social media site. In the United States, 90% of adults 18 to 29 years old have access to social media, making this platform a potential source for participant recruitment for the study on young college females (Bender et al., 2017).

In order to gain access to study participants permission from the Walden University Institutional Review Board (IRB) was obtained. The study was conducted in a city in northern West Virginia, which houses several colleges, technical schools, beauty schools and universities. This city was selected for the study because this is where I reside and the city and dormitories house approximately 27,729 college students (City of Morgantown, 2017). Recruitment took place off all campuses. There are numerous off campus college apartment complexes and single-family dwellings in which students rent or live with their families which gave me access to participants. My office is located just one mile off campus in which participants could easily walk to if they did not have transportation.

Participant recruitment for this study involved both Facebook and traditional dissemination of printed materials. Staffileno et al. (2017) stated that when using social media or traditional strategies for recruitment the researcher should include the eligibility requirements, compensation, how to receive additional information about the study, and contact information of the principal investigator by added an e-mail address and a phone number. The recruitment flyer for this study (Appendix A) was displayed in several locations. Next to the campuses of the educational institutes there is an outdoor mall which is frequented by students. Recruitment posters were hung in the grocery store, hair salon, tanning salon, and coffee shop. These settings are all places young college females commonly shop and interact. These locations have a community board for displaying jobs, items for sale, lost animals, fairs and festivals, or other information related to the community. For participants who wanted to look at the information on Facebook, the flyer directed them to a friend request. The same flyer was displayed on my Facebook page. To display the recruitment flyer on Facebook, approval was received from the Walden University IRB.

Once a potential participant made contact, criteria of the study was confirmed. To confirm WFT use, a screenshot of their WFT interface display was sent through a text message or e-mail. For those participants who met the criteria, an interview time was chosen, and an e-mail was sent to them the day before the interview takes place as a reminder. At the beginning of the interview, the consent form was read to make sure all participants understood they were voluntarily agreeing to an interview related to their experiences with WFT and have them sign the form. The information is being kept in a safe place in a locked cabinet in my office; they were able to check transcripts once the interviews were completed and transcribed, and any time they wished to discontinue the interview they had the right to stop. Creswell (2013) stated the consent form should include the right of voluntary withdraw by the participant from the study, procedures and purpose of the study, the protection of the confidentiality of the respondents, the known risks associated with participation in the study, the expected benefits, and the signature of the participant and the researcher. For participating in the study each participant received either a $20 gift card from Starbucks or a $20 gift card from Bath and Body.

**Instrumentation**

Observation, in-depth interviewing, focus group discussions, narratives, and the analysis of documentary evidence are methods used in qualitative studies data collection (Ritchie et al., 2013). Ritchie et al. stated as researchers are the main instrument in qualitative inquires they must be objective, take care not to influence the views of the participants, and remain neutral when collecting, interpreting, and presenting the results of their study. The instrumentation for the data collection for this study was the use of face-to-face interviews by the researcher. The in-depth interviews provided an opportunity for a comprehensive investigation of the participants' personal experiences with the use of WFT. The interviews offered both clarification and a detailed understanding of their lived experiences related to the phenomenon (Ritchie et al., 2013). The interviews were open-ended questions to gain in-depth information about the phenomenon of the study. Each interview was audio-taped to ensure verbatim data collection.

During the interview, good verbal skills, clarity when asking questions, and descriptive and analytical abilities to obtain in-depth information were displayed (Cleary et al., 2014). Cleary indicated that an interviewer with a clearly defined research topic and an adequate number of participants who have expertise in the phenomenon of the study can produce extremely relevant information for data analysis. The interview questions were based on the HBM, literature review and results from the field testing (see Appendix B).

The field testing was completed on November 17, 2018 prior to the initial interviews and conducted with two family members, my daughter, who is a college student, 23 years of age, who had worn a Garmin WFT for two years, and my niece, a college student at Penn State University, 24 years of age, who had worn a Fitbit Charge HR for one year. The field testing interviews gave me the opportunity to explore the practicability of the interview questions related to the use of WFT by young college students. Doody and Doody (2015) stated that field testing plays an important role for the researcher to develop necessary skills before started the data collection. The implementation of the field testing proved essential and allowed me to determine if the participants were interpreting the questions as intended, if the questions presented any issues or require changes, and if the collected data were allowing me to gain information based on the phenomenon. The field testing also gave me the opportunity to make important changes to these interview questions prior to the data collection.

## Data Analysis Plan

One of the most important phases of qualitative research is the data analysis process as it helps researchers make sense of their collected data by searching, evaluating, coding, mapping, describing patterns and themes, and provide causal meaning (Ngulube, 2015). Although qualitative data is collected and constructed from comparatively limited sources, there is an extensive amount of data that requires a management organizing technique (Ngulube, 2015). Ngulube stated that methodological accuracy and protection of the research data are important constructs of how the researcher manages and secures collected data.

Four types of data analysis include thematic analysis, comparative analysis, content analysis, and discourse analysis (Dawson, 2009). Dawson noted thematic analysis is highly inductive as themes emerge from the data, and comparative analysis, which is sometimes used simultaneously with thematic analysis, is when data are compared until the researcher believes there are no new topics. Dawson described content analysis as the researchers coding by content as they systematically work through data and noted discourse analysis is intuitive and reflexive and is when the researcher looks for patterns of speech in participants. For this study, thematic analysis was used.

Qualitative inquiries produce large amounts of textual data which makes the systematic and rigorous preparation of data analysis time consuming and laborious (Zamawe, 2015). To reduce the burden of time and labor the study on young college females I used the Computer Assisted Qualitative Data Analysis Software (CAQDAS) NVivo. NVivo allows the researcher to use features including character-based coding, retrieve quotes to find themes, rich text capabilities, and enable the grouping of codes into categories representing themes. NVivo also allows the researcher to compare new and previously coded data, retrieve chunks of data to examine similarities and patterns, and access multimedia functions necessary to manage the large amount of collected data (Woods, Paulus, Atkins, & Macklin, 2016; Zamawe, 2015). Zamawe noted that NVivo is not methodologically specific so its high compatibility will work for the phenomenological study.

After the interviews were conducted and saturation was reached, data analysis began. All memos and notes made during the interviews were reviewed and organized. Once this was completed interviews were transcibed. Wiens, Kyngäs, and Pölkki (2016) indicted all transcription should be done by the interviewer to avoid any omission of words or misinterpretation. The interviews were transcribed verbatim by me from the audio-tapes. Once the transcription took place each participant was notified by e-mail and provided with a copy of their interview for optional member checking or verification. Participants were also notified once the data were analyzed and sent a copy of the research reports via e-mail. Member checking is the method in which researchers return transcribed interviews or qualitative analyzed data results to participants to validate and verify the trustworthiness (Birt, Scott, Cavers, Campbell, & Walter, 2016). Participants were given one week from the date the transcription was sent to them via e-mail to make changes, ask additional questions, or request a second interview. This contact was through e-mail or phone.

Once all corrections were made, audio-tapes and transcriptions were reviewed and coding began using the qualitative data analysis software (QDAS) program NVivo Pro 11. Dillaway, Lysack, and Luborsky (2006) suggest once the researcher is familiar with the data collected, they should begin the coding process. Paulus, Woods, Atkins, and Macklin (2017) noted that, although NVivo is a tool to assist in data analysis, it is the researcher who develops the theories from the data. They also stated that QDAS programs are not a substitute for the core role of the researcher to search for the meanings of collected data and determine relationships of all nodes according to the characteristics of the subjects' experiences. Qualitative interviews result in a huge amount of collected data, so using NVivo allowed me to identify key words, use codes to develop themes, use memo-writing, and query the coded data into categories. This data can be stored so the researcher can identify, retrieve, or create matrix coding queries, such as summaries or reports. The use of NVivo increased the productivity and effectiveness of the data analysis process. NVivo allowed me to sort and code data in an iterative process.

Once the interviews were transcribed they were saved as a Microsoft Word document and imported into internal folders in NVivo as sources for the data analysis. The interviews saved in the internal folders were labeled with the participants first name. Nodes were generated from the interview transcripts and used in the coding process. Codes were labels that assign representative meaning to the descriptive information collected during a study and are attached to data chunks of varying size to detect reoccurring patterns (Miles, Huberman, & Saldana, 2014). These codes were then used to develop themes. Miles et al. posited coding is a deep reflection about the interpretation of the data's meanings. Saldaña (2015) stated a code can be a word or short phrase that characteristically assigns a collective, noticeable, essence-capturing attribute for a portion of data, and used in the data analysis process. As descriptive phenomenology and thematic analysis are iterative approaches, no predetermined codes were used. The codes were synthesized and grouped to form themes.

Dillaway et al. (2006) noted that once data analysis starts, researchers should make a duplicate copy of the original data and keep this in a secure place so there is no chance to ruin the original copy, such as a backup file on the computer. For this study, a Memorex SanDisk was used to copy the files and kept locked in my office. When the data analysis was completed, the final step was to report the findings. Edward and Welch (2011) indicated the results of the study should be developed into an exhaustive description or a comprehensive description of the experience as voiced by the participants. The results of this study were written into an exhaustive description of the codes, themes, meanings, and summary of their verbatim interview accounts and experiences.

## Issue of Trustworthiness

The purpose of exploratory qualitative research was to understand how people make sense of their lived experiences. The goal of trustworthiness or rigor in the study is for the researcher to accurately represent these experiences (El Hussein, Jakubec, & Osuji, 2016). For the study to be trustworthy, the inquirer looked for truth value, applicability, consistency, and neutrality (Lincoln & Guba, 1985). Schwandt, Lincoln, and Guba (2007) indicated the constructs for ensuring trustworthiness in a qualitative study is to employ credibility, dependability, confirmability, and transferability.

Noble and Smith (2015) noted several strategies for establishing validity and reliability in qualitative research and ensuring trustworthiness of the findings, include accounting for and acknowledging personal biases and keeping thorough records. They also noted strategies for validity and reliability as reporting a clear and transparent interpretation of data and ensuring comparisons of both similarities and differences in experiences. They indicted researchers should include rich and thick verbatim descriptions to support findings, demonstrate clarity in terms of thought processes during data analysis, engage with other researchers to reduce researcher bias, member checking, and data triangulation. To ensure trustworthiness in the qualitative study, researchers must report the findings, including how the study was conducted, procedural choices, and a transparent and explicit collection and management of data (Hammarberg, Kirkman, & De Lacey, 2016). Hammarberg et al. also proposed that to ensure trustworthiness, adequate description, explanation, and justification of the methodology and approaches, it should be easy for readers and reviewers to follow the events and understand the logic.

## Credibility

Credibility refers to the truth of the participants' experiences and the researcher's interpretation and representation of them (Cope, 2014). Cope suggests that a qualitative study is considered credible if the descriptions of an experience are recognized immediately by individuals that share the same experience. Strategies of research credibility and rigor for this study will be reflexivity, thick description, and member checking. Hays, Wood, Dahl, and Kirk-Jenkins, (2016) stated that credibility for qualitative studies should also include sampling adequacy.

Houghton et al. (2013) noted that member checking, which involves participants reading the transcribed interviews for accuracy before data analysis occurs, also increases the authenticity of the study. For this study member checking was optional following transcription of the data. This increased the credibility of the study by having participants acknowledge and respond to their own words. Each participant was sent a copy of the transcribed interview via e-mail with an option to make changes or contact me with any concerns regarding revisions of the transcription. Also, member checking for this study included participants being sent a copy of the emerging findings and a draft copy of the research report to optionally review. Thomas (2017) indicated that the researcher should present participants with their interpretation of the data report, to allow them to comment on the researcher's findings and interpretations of their own words. Thomas suggests this gives the participants a chance to confirm or deny that the summaries reflect their views and experiences and support or challenge the researchers' understandings.

Reflexivity is the awareness of the influence the researcher has on the individuals or phenomenon being studied while recognizing how the research experience is affecting him or her (Probst, 2015). Probst suggest that engaging in reflexivity during planning, conducting interviews, and reviewing previous literature in the study will promote a continuing and repetitive relationship between my own subjectivity and the intersubjective dynamics of the research process itself. Reflexivity throughout the study will include using written field notes by the researcher. Probst stated that the awareness of one's subjectivity develops through an internal process that is supported by external activities. Hence, reflexivity will be used in the study to increase the confidence and credibility of the findings as it will allow me to pursue bracketing and control my own subjective biases (Darawsheh, 2014).

## Transferability

Applicability of the research findings is the measure for evaluating external validity (Hammarberg et al., 2016). Hammarberg et al. specified that if other researchers can transfer and view the study's findings as meaningful and applicable to other studies outside the context of the study, it is considered to meet the measure of transferability. Quick and Hall (2015) agreed that even though the experiences of participants are specific to a certain social setting for one study, transferability may be possible if the reader is able to apply the findings to other experiences or situations.

To ensure transferability, thick and rich description of the research process and findings is necessary so other researchers can apply the ideas to their own work and settings or replicate a study (Goldberg & Allen, 2015; Hays et al., 2016). Goldberg and Allen (2015) stated that thick and rich description illuminates the method to communicate the connection of the theory to the findings and of integrating both descriptive and interpretive reports when presenting qualitative findings. Fusch and Ness (2015) differentiated between rich and thick data as rich being quality, intricate, detailed, and nuanced data, and thick as a lot or quantity of data. They suggest that qualitative research needs both to assume transferability.

Rich and thick data and an appropriate research study design supply the best opportunity to answer the research questions. In this study, transferability was established by using the data collected from interviews and reporting a thick description of the lived experiences of the participants in the findings. Direct quotes are included in the study's findings to provide rich, detailed, thick descriptions. A detailed description of the research methods was also provided. Colorafi and Evans (2016) stated that to aid in transferability, the researcher should fully describe the characteristics of the participants for comparison to other populations. For this study, the population in detail was identified by describing all characteristics of the participants. In addition, all findings of the study were reported. Suggestions were also provided for ways that the findings from this study could be tested by other researchers, which is an important concept for transferability (Colorafi & Evans, 2016).

## Dependability

Dependability refers to the lucid, observable, and carefully documented research process that ensures that the findings of the study are consistent and replicable (Kihn & Ihntola, 2015). Dependability can be accomplished by consistency in procedures over time using several methods during data collection, such as audit trails and reflexivity (Colorafi & Evans, 2016). Bengtsson (2016) specified dependability is a concept that relates to the degree of the researcher's ability to manage and understand collected data as they change throughout the study. Bengtsson stated the researcher must keep track of coding, use memoing to track changes in the progress, and understand the need for recoding and relabeling.

Houghton et al. (2013) noted that readers of the study should be able to understand the methods by which the findings have been reached and suggest achieving this can be done by the researcher using an audit trail. Houghton noted the audit trial is a method of maintaining comprehensive notes related to the background of the study and the purpose for procedural decisions. NVivo was beneficial as a data management tool as it allowed me to increase dependability in the study by auditing findings and aid in reflexivity during data collection and data analysis (Houghton et al., 2013).

For this study, transcribed interviews were uploaded into NVivo. NVivo was used to code responses and analyze the transcribed qualitative interviews and organize and manage transcriptions to find insights in the data efficiently. NVivo can save researchers time, quickly organize, store, and retrieve data, find connections, and back up findings with evidence to increase dependability (QSR International, 2017).

## Confirmability

Connelly (2016) indicated confirmability is the idea that findings are reliable and replicable. Methods to ensure confirmability include methods that were used for transferability, including an audit trail of procedural memos and detailed notes of all decisions and analysis as it progresses. Connelly suggested to prevent researcher bias, interview transcripts can be reviewed by participant member checking. For this study, an audit trail, memoing, and member checking were used. Memoing allowed me to read and reflect on my notes to ensure the experiences of the participants are their ideas and not my own.

## Ethical Procedures

An important component of the design of the study is related to ethics, since data collection from qualitative study participants are personal and from a small sample of individuals (Twining et al., 2017). Creswell (2009) indicated researchers must be aware of the ethical issues that arise during their study, as they involve collecting data from people, about people. Creswell posited the researcher needs to develop a trust and protect their participants, guard against misconduct that may reflect on the institution, and manage all challenging issues. As all researchers understand the importance of gaining ethical approval for their research (et al., 2017), an approval was obtained from the Walden University Institutional Review Board prior to conducting the study on young college females for both the legal protection of myself and the participants.

An informed consent must be signed by participants before they engage in the research (Creswell, 2009). The consent form included; a brief description of the purpose of the study, the inclusion criteria, researcher and institutional identification, voluntary nature of the study, sample interview questions, risks and benefits to participants, guarantee of confidentiality and privacy of data protection, assurance of withdrawal by the participant at any time, and contact information of the main investigator. For this study, the informed consent form that is provided by the Walden IRB, was used.

Twining et al. (2017) specified the researcher must discuss how the research findings for the study will be reported. Dempsey, Dowling, Larkin, and Murphy, (2016) indicated that researchers need to uphold beneficence and non-maleficence. Dempsey et al. stated to protect a participant's identity, transcripts of interviews and data should only be seen by the researcher and that the findings should be reported in a manner that the participant is unidentifiable. For this study, numbers from 1 to 10 were used to protect the identity of the participants. The Walden IRB also requires that students complete the National Institutes of Health training on treatment of human participants, which I have done. Additionally, all recruitment materials were reviewed and approved by the Walden University IRB.

Creswell (2009) stated that an ethical issue related to confidentiality of which researchers must be aware is that some participants will not want their identity revealed. By allowing this, the researcher gives the participant ownership of all text and independent decision making (Creswell, 2009). The data collected for the study on young college females was confidential and only seen by myself and my dissertation committee at Walden University. All data was locked in my office during the study. No one other than myself had access to this information. Obtaining the ethical approval was the last step before implementing the study (Dillaway et al., 2006).

## Summary

In chapter 3, an introduction of the study was provided and the research questions were restated. The research design and rationale were discussed in detail and included the qualitative approach, philosophies to the approach, and the rationale for choosing the descriptive phenomenological approach. In this chapter, the importance related to my role as the researcher was discussed. The section on methodology discussed participant selection, the sampling strategy, sample size and recruitment of participants. In the section on instrumentation, the data analysis plan was revealed, along with the selection of NVivo for transcribing and coding, and data saturation. The issues of trustworthiness included individual sections on credibility, transferability, dependability, and confirmability. Ethical procedures were included in the last section related to confidentiality, consent forms, and approval by the Walden University IRB.

Chapter 4 included the information on the informal interviews, interviews, setting, and demographics. Also, in chapter 4, the data collection, data analysis, evidence of trustworthiness, and the results of the study on young college females and their intent for behavior change with the use of WFT were discussed in detail.

# Chapter 4: Results

## Introduction

The purpose of this qualitative phenomenological study was to describe the experiences of young female millennials attending colleges located in a small city in northern West Virginia and their intent for behavior change with the use of WFT. The HBM was used as the theoretical framework for the study and provided a lens to explore the lived experiences of young college females and their use of WFT, including constructs such as motivators, barriers, perceived susceptibility, perceived benefits, and self-efficacy. Data were gathered from 10 college females during face-to-face semistructured interviews. The participants detailed their experiences surrounding their use of WFT related to physical activity, nutrition, health behavior, and health issues. In this chapter, a thorough explanation of the interview process, a synopsis of the participants, how data were collected, the data analysis process, the study's findings, storage of data, and themes that emerged through the data analysis process are included. The interviews were guided and presented as they relate to the three main research questions.

## Research Questions

Research Question 1: What is the intent of young female college students with the use of WFT?

Research Question 2: What are young female college students' lived experiences with the use of WFT?

Research Question 3: What are the lived experiences of WFT use by young female college students and their intent for behavior change?

## Recruitment of Participants

The participants for this study were recruited by posting a recruitment flyer (Appendix A) in local businesses and through Facebook. The recruitment flyers were hung on the community board in three locations of Starbucks coffee shops, Kroger's grocery store, and Tanning World tanning salon; all businesses were located next to the campuses of all colleges, technical schools, and universities. The recruitment flyer was also displayed on my personal Facebook page. The IRB approval number for this study is 11-15-17-0503349. The participants were recruited from November 15, 2017 through December 22, 2017. Participants for the study responded to the recruitment flyer through the information provided by either a text message, e-mail, or phone call. Once the initial contact was made, a response replicating their method of contact was used to confirm the participants met the study criteria. Once it was established that the participant met the inclusion criteria, a date and interview time was agreed upon by both the researcher and the participant. The study criteria required participants to be 18-25 years of age, female, attending a college or university in northern West Virginia, currently wearing and using the WFT for a minimum of 6 months, be tracking daily physical activity and nutrition data, syncing collected data to a smartphone or computer, and be willing to participate in an interview to talk about these experiences. Table 1 displays the contact date, date interviewed and length of interview.

Table 1

*Details of the Interviews*

| Participant | Contact date/Study criteria date | Date interviewed | Length of interview |
|---|---|---|---|
| Participant 1 | November 18, 2017 | November 20, 2017 | 22:00 |
| Participant 2 | November 21,2017 | November 22, 2017 | 27:48 |
| Participant 3 | November 22, 2017 | November 25, 2017 | 43:47 |
| Participant 4 | November 26, 2017 | November 29, 2017 | 27:29 |
| Participant 5 | November 26, 2017 | November 29, 2017 | 36:59 |
| Participant 6 | November 28, 2017 | December 1, 2017 | 33:05 |
| Participant 7 | November 30, 2017 | December 7, 2017 | 41:51 |
| Participant 8 | December 11, 2017 | December 13, 2017 | 45:17 |
| Participant 9 | December 11, 2017 | December 16, 2017 | 26:12 |
| Participant 10 | December 20, 2017 | December 22, 2017 | 25:03 |

## Setting

All the participants were interviewed in my private office. The office is located within one mile of all college campuses. The office setting is professional, private, and quiet, which provided a safe, confidential, and inviting environment. To reduce potential researcher bias because I own and operate a fitness facility and have experience with physical activity, nutrition, and WFT, I wore a skirt and jacket rather than normal workout attire, which includes workout pants, workout jacket, and exercise shoes. I also did not wear my Garmin WFT. All participants were greeted by me at the door and led to a chair that faces the desk. After the initial introduction, each participant read and signed the consent form. I then preceded with the interviews. All interviews took place at the time originally scheduled except for Participant 8, who cancelled and rescheduled due to a conflict at school. All participants seemed comfortable and willing to talk about their experiences with the use of their WFT. Participant 3 referred two of her classmates to take part in the study and Participant 9 referred Participant 10; therefore, the snowball sampling method was used for participant recruitment.

## Demographics

The participants were asked six questions under the main topic of Demographic Questions (Appendix B). The 10 participants for the study attended two different colleges. Six of the 10 participants were natives of West Virginia, three participants were from Pennsylvania, and participant 6 was from New Jersey (Table 2). All participants had access to a school exercise facility which was included in their tuition. Only two participants chose to use the school meal plan. The age range for the participants for the study was 19 to 24 years of age, with the average age of 20.7. Table 2 presents the data from all participants including age, school, degree, level of education, access to exercise facility and meal plan from their school, and home state.

Table 2

*Demographics for the Study Participants*

| Participant | Age | Degree/Level | Access to exercise facility | Access to nutrition plan | Home state |
|---|---|---|---|---|---|
| Participant 1 | 21 | Pre-Medical Laboratory Science/Senior | Yes | No | PA |
| Participant 2 | 21 | Social Work/Junior | Yes | No | WV |
| Participant 3 | 20 | Criminology/Junior | Yes | No | WV |
| Participant 4 | 21 | Veterinary Tech Program/Senior | Yes | No | WV |
| Participant 5 | 20 | Criminal Forensics/Junior | Yes | No | WV |
| Participant 6 | 23 | Agricultural Education/Masters | Yes | No | NJ |
| Participant 7 | 20 | Human Nutrition and Foods/Junior | Yes | Yes | WV |
| Participant 8 | 19 | Occupational Therapy/Freshman | Yes | Yes | WV |
| Participant 9 | 21 | Social Work/Senior | Yes | Yes | PA |
| Participant 10 | 21 | Criminology/Senior | Yes | Yes | PA |

The participants of the study each had a specific criterion for their choice of WFT. The Fitbit was the most popular choice as six of the 10 young college females used the following Fitbits that best met their physical activity and nutrition criteria: Fitbit Flex 2, Fitbit Charge HR, Fitbit Blaze, Fitbit Charge 2 HR, and the Fitbit Charge 2. Three participants wore the Apple Watch Series 1. One participant wore the Polar 360. Table 3 presents the brand of WFT they used in the study, the length of time worn, the physical activity and nutritional aspects for choice of WFT, and additional criteria for brand choice.

Table 3

*Criteria for Brand of WFT*

| Participants | Brand of WFT | Length of Time Worn/Shares Data | Physical Activity Reason for Choice of WFT | Nutritional Reason for Choice of WFT | Additional Reasons for Choice of WFT |
|---|---|---|---|---|---|
| Participant 1 | Apple Watch Series 1 | 8 months Yes | Tracks Steps | Tracks Calories Burned | Tracks Heart Rate Interface/Screen Displays Text Messages Displays Calls Syncing Capability |
| Participant 2 | Fitbit Flex 2 | 24 Months Yes | Tracks Steps | Tracks Calories Burned | Tracks Sleep |
| Participant 4 | Fitbit Charge 2 | 24 Months Yes | Tracks Steps | | Syncing Capabilities Watch Display |
| Participant 5 | Apple Watch Series 1 | 48 Months Yes | Tracks Steps Tracks Weight Lifting Tracks Swimming Physical Activity Goal Setting Competition Capabilities Alerts to Move | Tracks Calories Burned | Syncing Capabilities Waterproof Displays Blood Pressure |
| Participant 6 | Fitbit Charge 2 HR | 48 Months Yes | Tracks Steps Tracks Distance | | Tracks Heart Rate Interface/Screen Tracks Sleep Watch Display |
| Participant 7 | Apple Watch Series 1 | 9 Months Yes | Tracks Sports Activities Tracks Aerobic Activity Tracks Weight Lifting | | Interface/Screen |

*(table continues)*

| Participants | Brand of WFT | Length of Time Worn/Shares Data | Physical Activity Reason for Choice of WFT | Nutritional Reason for Choice of WFT | Additional Reasons for Choice of WFT |
|---|---|---|---|---|---|
| Participant 8 | Fitbit Blaze | 7 Months Yes | Tracks Aerobic Activity Tracks Weight Lifting | Tracks Calories Burned Tracks Calories | Tracks Heart Rate Interface/Screen Tracks Sleep Inexpensive Cost |
| Participant 9 | Fitbit Charge HR | 12 Months Yes | Tracks Steps | Tracks Calories | Tracks Heart Rate Interface/Screen Displays Text Message |
| Participant 10 | Fitbit Flex 2 | 8 Months Yes | Tracks Steps Tracks Swimming | Tracks Calories Burned Tracks Calories | Tracks Swimming |

## Data Collection

Twelve individuals responded and inquired about the study from the recruitment flyer. Potential participants were told about the approximate length of the interview, the criteria, and what type of questions would be asked during the interview. Participants were then asked questions to see if they met the inclusion criteria. Two individuals did not meet the study's criteria; one was a college student but was currently taking time off from classes due to an illness, and the second potential participant had not worn her WFT for the length of time required by the study which was a minimum of 6 months. The remaining 10 met the criteria and agreed to do the interviews. The date and time were agreed upon by each participant and the interview was then scheduled. Each participant was contacted via text message or Facebook message one day prior to the interview as a reminder of the time, day, and directions. The participants were asked in the message which of the two gratuities, a $20 Starbucks or $20 Bath and Body card they would like. The card preference, along with the participant's name, interview date and time, were noted in a Microsoft document. All interviews except one were conducted on the day scheduled. Participant 8 had to reschedule due to a conflict at school.

Individual face-to-face, semistructured interviews took place between November 15, 2017 and December 22, 2017. Each interview began with introductions. Once the introductions took place, each participant was welcomed and thanked for agreeing to participate in the study. The interview protocol (Appendix B) was used as a guide. The participants were told how their responses would provide me with an understanding of the experiences young college females have with the use of WFT. The participants were handed a copy of the consent form which provided information on the purpose of the study, the procedures, that participation was voluntary, the risks and benefits of being in the study, that their identities would not be shared, the data would be stored safely and not used for any other purpose except this study. The participants were given time to read the document and ask any questions. Once the consent form was signed, they received a copy and they were made aware that notes would also be taken by me. All participants were told they would be receiving their gratuity of a $20 gift card for their time, which was selected prior to the interview when the interview was completed. They were then asked if they had any additional questions. All participants proceeded without any questions.

**Data Analysis**

Interviews were audio-recorded using a Phillips VoiceTracer recorder. Once the interviews were completed, they were transcribed verbatim into a Microsoft Word document. As suggested by Wiens et al. (2016), all interviews were personally transcribed by me to avoid any omission of words or misinterpretation of the data. The audio-recordings were listened to several times by me while reading the transcriptions to correct any errors and to ensure accuracy and validity. The transcripts were read and reread multiple times to acquire a better understanding of the participants' experiences and make sense of their interpretation. Colaizzi's method (1998) indicates that reading and rereading the transcripts is the first of seven steps researchers can use to guide descriptive phenomenological studies. All memos and hand-written notes on the interview protocol made during each individual interview were reviewed, organized, and uploaded the typed Microsoft document into a node in NVivo 11 Pro labeled "Researcher Memos" because Bengtsson (2016) stated that researchers should use memoing to keep track of notes made during the interview process and during the coding and labeling process. These memos were also read and reread which allowed me to reflect on my notes to ensure the experiences of the participants were their ideas and not my own. Participants were also notified by e-mail and provided with a copy of their interview transcription for optional member checking or verification, which follows step six of Coliazzi's method. The e-mails were sent on December 28, 2017 and participants were given 1 week to respond. As of January 5, 2018, no follow-up e-mails from participants had been received; therefore, step seven of Coliazzi's method of incorporating changes offered by participants in the final description of the study was not used.

The interviews were uploaded into NVivo 11 Pro. NVivo 11 Pro is a Computer Assisted Qualitative Data Analysis Software (CAQDAS) program that offers functions for creating memos, interview notes, uploading interview transcripts, creating cases, and assigning nodes to the data to provide an index of the categories (Wood et al., 2016). Wood et al. also stated NVivo allows the researcher to retrieve and review data by running a matrix coding query for repetitive words or phrases, compare newly coded data with previously coded material to examine reoccurring patterns, display reports in a table format, and group codes into categories to develop themes. Using step 2 of Colaizzi's method, responses were extracted from the participants' transcriptions that significantly related to the experiences and phenomenon of intent of behavior change with the use of WFT. The next step of data analysis was to create formulated meanings hidden in the various contexts of the data for emergent themes that were common to all participants; steps three and four of Colaizzi's method (Colaizzi, 1978). Coding began by assigning parent nodes to the main interview topics which included demographic questions, perceived susceptibility, perceived barriers and benefits, self-efficacy, and aspects of WFT from each interview transcript. Once the parent nodes were developed the responses under each topic were read. Clusters of similar responses and repetitive words were extracted and generated child nodes. A word frequency query was run in NVivo Pro 11 to better understand which words were used most by the participants. Castleberry (2014) stated researchers choose word clouds to display frequently appearing words in text to provide context to the data. Figures 1 and 2 are word clouds generated from word frequency queries. The first word frequency query was run with a minimum word length of 5 characters and level of exactness was set at "including stemmed words" with 50 maximum number of words. A word cloud was created within NVivo Pro 11 (Figure 1). The second word frequency query was run with a minimum word length of 10 characters and level of exactness at "including stemmed words." Figure 2 presents the results of the second query. The most frequently used words from the interview transcripts were used along with clusters of data extracted from the interviews to generate codes.

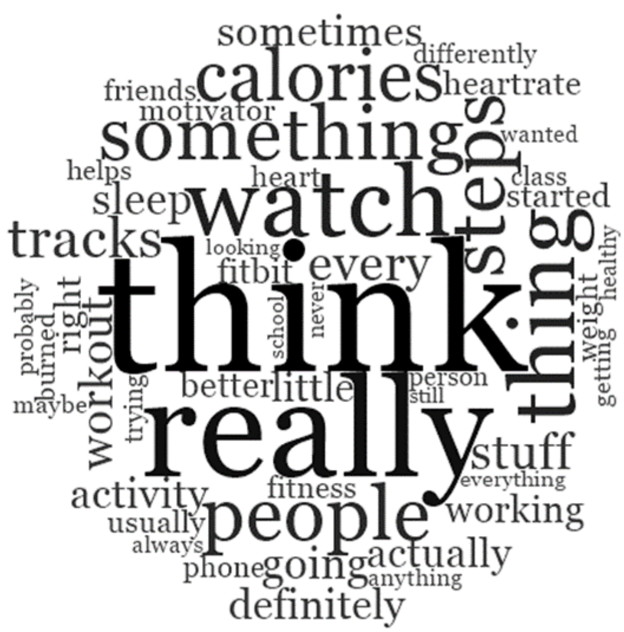


*Figure 1.* Word cloud from interview transcripts (five characters).

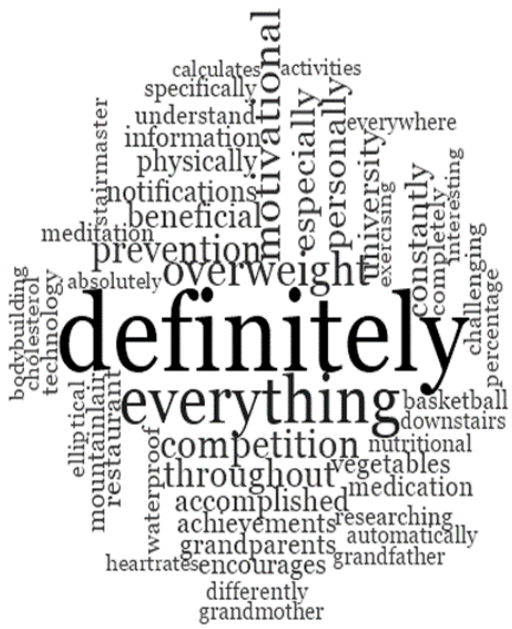


*Figure 2.* Word cloud from interview transcripts (10 characters).

More specific data related to the word clouds were used to create a second child node. Once these data were extracted all second child nodes were labeled central ideas, which then led to codes and themes. Nine themes emerged from the data collected from the participant interviews. All ten participants responded to 23 interview questions. The first five questions were not used in the data analysis. They were as follows: please tell me your name and how old you are. please tell me what college you attend, what year you are in your chosen degree or career path and if you live on or off campus, please tell me where you are previously from if West Virginia is not you home state, please tell me how long you have been using the WFT and describe your choice of WFT and the criteria for choosing that brand. The remainder of the interview questions were asked to produce meaningful data related to the research question. Table 4 presents the research questions and the interview questions that correspond with each.

Table 4

*Corresponding Interview Questions*

| Research Question 1<br>What is the intent of young college females with the use of WFT? | Research Question 2<br>What are young female college students' lived experiences with the use of WFT? | Research Question 3<br>What are the lived experiences of WFT use by young female college students and their intent for behavior change? |
|---|---|---|
| • Please tell me about your current physical fitness activity and goals related to physical fitness activity. | • Please tell me about any specific or personal health benefits of your use of WFT | • Please tell me some reasons why you continue to use WFT. |
| • Please tell me about your daily nutritional behavior and any goals related to your nutritional habits. | • Please describe your experiences of any individual physical or mental change that have occurred since using the WFT. | • Please describe your experiences with the WFT message alerts related to physical activity and physical activity goals and describe the influence this feedback |
| • Please describe your experiences of health issues in young college females. | • Please describe your experiences with tracking syncing and sharing data from WFT related to health benefits for young college females. | Please tell me about your experiences with the WFT interactive capabilities of competing with other users through social networking. If you are not using the |
| • Please describe any personal or family history related to health issues that may have encouraged you to choose the use of WFT. | • What do you perceive as barriers being a young college student towards reaching your physical activity or nutritional goals with the use of WFT. | • interactive capabilities of the WFT, please tell me why you choose not to interact with other users.<br>• Please describe the technological aspects of WFT you perceive necessary for changing the health behavior of young college female millennials. |

*(table continues)*

| Research Question 1<br>What is the intent of young college females with the use of WFT? | Research Question 2<br>What are young female college students' lived experiences with the use of WFT? | Research Question 3<br>What are the lived experiences of WFT use by young female college students and their intent for behavior change? |
|---|---|---|
| • Please describe any influences on how you perceive on how your health or health issues with the use of WFT related to health prevention. | • Please describe any experiences of feeling confident in the ability to reach your physical activity and nutritional goals and the use of WFT. | Please tell me about an experience that sticks out in your mind about the use of the WFT when you first started wearing the tracking band. What about now that you have worn the WFT for at least 6 months. |
| • Please describe your experiences of the use of WFT by young college females related to health education. | • Please describe your experiences with motivation and adherence to<br>• physical activity and healthy eating habits and the use of WFT. | • What else would you like to share about your experience with WFT. |

## Themes Associated with Research Question 1

The first research question was "What is the intent of young college females with the use of WFT?"  To produce relevant responses to the lived experiences, questions were related to the use of WFT and physical activity and nutrition goals.  Other topics related to research question 1 were health issues in young college females, family and personal health history, perceived health, health prevention, and health education. Themes 1 through 5 emerged from the participants' responses related to research question 1 (Table 5).

Table 5

*Themes 1-5*

| Theme | Codes | Central Ideas |
|---|---|---|
| Theme 1: Importance of Calories Tracking | • Calorie Counting<br>• Energy Expenditure | 1. Self-awareness of monitoring calories |
| Theme 2: Awareness of WFT Nutritional Data | • Syncing Nutrition Data to Mobile App<br>• Following the WFT Nutritional Data | 2. Importance of burning calories<br>3. Setting caloric goals<br><br>1. Syncing data to My Fitness Pal or phone app<br>2. Following the recommended nutrient breakdown of the WFT app |
| Theme 3: Impact of WFT on Physical Activity | • Tracking Physical Activity<br>• Physical Activity Goals<br>• Reaching the Goal<br>• Competing with the WFT<br>• Monitoring Heart Rate During Physical Activity | 1. Viewing step count, distance, goals<br>2. Positive changes in physical activity<br>3. Competing with your friend and community<br>4. Understanding how heart rate correlates with physical activity |
| Theme 4: Health Risks Encourage WFT Use | • Perceived Susceptibility<br>• Family and Genetic Health Issues | 1. Family hearth disease, high blood pressure, cholesterol, type 2 diabetes |

*(table continues)*

| Theme | Codes | Central Ideas |
|---|---|---|
| | • Personal Health Issues in College Females | 1. Cultural and family struggles of being overweight and being obese<br>2. ADHD, type 1 diabetes, overweight, and obesity<br>3. Lack of sleep, being overweight and being obese<br>4. Genetic and personal health issues promote the use of WFT |
| Theme 5: WFT is Educational | • Educational Device Provides<br>• Data for Improved Health | 1. Encouragement and incentive for researching health-related data<br>2. Education on realistic goal-setting and healthy living<br>3. Educated young college females about the need for staying active |

**Theme 1: Importance of Calorie Tracking**

Two codes were used to determine theme 1: calorie counting and energy expenditure. Participants responded to questions about their nutritional goals with WFT by talking about the number of calories they burned during both cardiovascular training and strength training. Central ideas related to theme 1 were self-monitoring calorie intake, importance of burning calories, and setting caloric goals (Table 5), all important factors for reducing being overweight or being obese in young college females. Participants' responses suggest that their intent with the WFT related to their nutritional behavior is to eat and burn a specific number of calories and walk a minimum of 10,000 steps per day to meet personal caloric goals. Therefore, as WFT can track calorie intake and calories burned, the participants of the study focused on both aspects. Participant 1 experienced excitement that she had access to this data directly from her WFT, and although she understood tracking her calories would help her reach her goal, she did not always make that goal. She said:

> It keeps track of your calories, and it's right on your wrist. I have my goals on here . . . I go by calories . . . I think I have like 340 calories left to lose today. I usually don't make that, but I try.

Participant 3 indicated that most young college females like counting calories; however, she said she felt young college females needed to look at more than just how many calories they eat each day. She said:

> Girls love counting calories, at least my roommates do, that's all they count, and I'm like . . . you have to look at a little more than that. I think the most important part of it, like, you can have your fitness watch and workout, but if you don't eat right, then you're not really working towards anything.

The participants shared experiences that having the ability to track and monitor both their intake and expenditure of calories aided in decisions related to increased physical activity. Participant 4 responded by saying the data collected from her WFT helped her know how much more physical activity she needed to burn off calories. She said:

> The Fitbit tells me how many calories I burn. If you know how many calories you need to eat in a day to have a healthy diet, but you're also burning off calories, it kind of goes along with the nutrition for me. That way if you want to burn more calories you do more activity . . . to burn more calories . . . and you want to do that.

Participant 8 shared her experiences with the use of WFT and energy expenditure. She said:

> So . . . with the watch, it helps, and it tracks calories you burn, and it shows you . . . like . . . how many minutes you were, like, fat burning, how many minutes you were calorie burning, like . . . it's in the app and you can go back and look at it, and at your performance, and stuff like that.

Participant 9 also responded by saying that most young college females use their WFT to see how many calories they burn each day. She said:

> Many girls get the watch, you know, to see how many calories they are burning . . . I think most girls . . . more than my guy friends . . . like looking at the calorie kind of thing . . . that seems to be really important to them.

Participant 10 is an active swimmer. She stated she is a sprinter, so she likes that she burns more calories when she swims than those students who are distance swimmers. Participant 10 responded to the use of WFT to collect data related to energy expenditure. She said:

> I love it . . . the . . . Fitbit, because, I know how many calories I am burning because I run around a lot, like, I hardly sit down, and I feel like by having the watch, I know how many calories I burned when I'm at school. Actually, since I am a swimmer, when I swim, I want to burn as many calories as possible, and you burn so many calories per, like, every 5 laps. I'm a sprinter, so, my calories are burned faster than distance swimmers, so that's a good thing to track that on your Fitbit.

**Theme 2: Awareness of Wearable Fitness Technology Nutritional Data**

Theme 2 was developed from the following codes: syncing nutritional data to mobile fitness app and following the WFT nutrition data. The following central ideas were used in the coding process; syncing data to My Fitness Pal or phone app and following recommended nutrient breakdown of the WFT app (Table 5). The participants discussed syncing foods to their Fitness Pal or phone app and their eating patterns related to recommended nutrients. In response to her experiences with WFT and nutrition, participant 5 felt that she was able to make healthier choices and found the nutrition app was an exciting way to log healthy foods. She said:

> My mom convinced me to do the My Fitness Pal thing where if you don't know the calories of something, you can like look it up and see it, so I'm trying to make conscious decisions right now.

Participant 2 used the WFT to link food to an app on her phone to try and make better food choices on campus. She said:

> I have an app on my phone, linked to my watch and it tracks everything you eat, and it would help you, like, reach your nutritional goal. It's not easy being on campus and eating healthy foods, but I try and eat healthy.

Participant 7, who also wears an Apple watch had similar responses about her daily nutrition and healthy eating goals as participant 5. She said

> I use it to track my nutrition, and just, kind of, my meals. It goes with the My Fitness Pal app on your phone, and you can put in your different foods, and it calculates your calories, and it kind of goes with the watch and how many calories

> you tracked and burned on your watch, which is kind of nice. My calories are 1600, I think, and I'm not tracking, specifically, macronutrients, but I do know I have more carbs than protein, I think that's what's better for me, just by, I'm always active, especially at work, I'm always on my feet, constantly moving around, and I need those (carbs).

Participant 8 said:

> Um . . . the Fitbit . . . it does not . . . track food, but, in the app . . . it syncs with My Fitness Pal . . . which is like a food log app. And, I like it, it works well. My Fitness Pal has the barcode option, so, you can just, like, scan the barcode, and it brings up everything, you don't have to look at the label. You can see caloric intake, you can see calories, you can see macronutrient breakdown because it brings up the entire nutritional label.

Also, Participant 8 uses her Fitbit to track food. She has type 1 diabetes. She responded to the nutrition questions by talking about her healthy eating habits. She shared her experiences with dietary modification and nutritional behavior related to her disease. She said:

> The watch syncs your calories to an app on the iPhone. I am very aware of nutrition labels, and how many calories in the serving size, and, obviously, how many carbs, because when I read a nutrition label before I put food in my mouth, I read the whole thing. Because it's like, eating something so little will spike my blood sugar.

**Theme 3: Impact of Wearable Fitness Technology use on Physical Activity**

Theme 3 was developed from the following codes: tracking physical activity, physical activity goals, reaching the goal, competing with the WFT, and monitoring heartrate during physical activity. To better understand the intent of WFT related to physical activity, four central ideas were used to generate the codes and theme, including viewing step count, distance, goals, positive changes in physical activity, competing with your friends and community, and understanding how heartrate correlates with physical activity (Table 5).

Physical activity such as walking, or weight training, is one of the effective ways to reduce risks of noncommunicable diseases and increase health benefits. For the participants in this study, physical activity behaviors were influenced by the complex interaction of self-regulatory skills of the WFT and their social environment. The participants shared their experiences with use of WFT and the impact the instant feedback of the device had on increasing self-awareness of their physical activity. Participant 1 logged her activity and felt the goals set by the Apple watch were high and meeting this goal was dependent on how busy her current schedule for the week was. She said:

> Every time I do go to the gym I put everything I do in my watch. If there’s a Stairmaster, I put that in. You can put walks, outdoor and indoor. You can put any of your exercise in the watch, and it does go in your exercise ring. The Apple watch gives you a standing goal, exercise goal, and a moving goal. Every week it gives you an update of how close you’ve been during the week (to make your

goal), and it tells you a suggested goal, so you meet it every day, but I usually change it . . . and I have to turn it down depending on how my week went, just to try and meet them (goals).

Participant 2 shared her experiences with goal setting and the use of her Fitbit. She stated she normally makes the goal and tries to increase the recommended 10,000 steps per day by 5,000. She said:

> I use my Fitbit to track just my steps, mostly, and I try to get, like, at least 15,000 a day. I normally make the goal set at 10,000 steps, and I want to do more so I set my Fitbit for a goal of 15,000 steps per day. I like to look at steps . . . and it tells me to stand up sometimes if I've been sitting too long. That's a good thing.

Participant 6 used her WFT to track her walking to meet her physical activity goals. She said:

> I use the Fitbit to keep track of walking because I am really into walking long distances, and I am really concerned how much I walk from class to class just, so I know how much I need to add to my daily fitness goals.

Participant 7's use of the WFT for fitness goals was to utilize the options of the fitness band to not only track cardiovascular training but also her strength training. She said:

> Right now, I try to work out 4 or 5 times a week if I can around school and work, mostly. I do lift a lot more than I do cardio, just like . . . I don't know, I want to put on more muscle mass right now. So, that's kind of my thing, and I like that

the Apple watch has its own option to do some of that stuff, but I do cardio on some days, so I can change it . . . the settings . . . to where it tracks that better.

The participants in the study experienced both physical activity goal setting and friendly competitions by connecting with other users to motivate and encourage each other. Several of the participants responded to the questions about the competitive aspect of the WFT. Participant 1 said:

I really like competing against other people . . . like the steps, I like to compare.

Participant 2 said:

There is an app on my Fitbit, and in one column it shows all your friends, and it's kind of, like, a competition to see who can get the most steps every day. I like it.

Participant 3 said:

I also chose to compete with my mom because she's my family, but I chose these two other people to compete with also because I kind of want to show off that I've reached my goals to my one friend . . . and the other one I've been competing with since we've been talking because we've always talked about competing, and I like to try and beat him.

Participant 5 said:

You compete against your friends, so a lot of people that have Apple watches can sync together and watch each other's progress. They set like monthly and holiday goals and everything, so it's like kind of cute . . . so sometimes it'll be on a Sunday, and I don't go to the gym on Sunday . . . so sometimes I'll go to the gym just to get that achievement. On the My Fitness Pal there is something that says, "join this challenge." You can win stuff, and yada, yada, yada, and you can rank in a certain space, and I thought that's really cool, and everyone can see what you're doing . . . so now I feel good about competing with other people and not just my mom and my friend.

Participant 6 talked about the impact the use of the WFT had on her and her fellow college marching band members. She experienced a sense of accomplishment with the number of steps she was able to complete. She said:

> I know that throughout my time in marching band in undergrad, it was constantly, who's going to get the most steps in, who's going to be, because I don't know if you know this, but when you're marching on your feet, you can't get any extra steps, so it was like who's going to get, so it was like who's marching the most, or who's walking during classes throughout the day. It was a competition for 300 people in band that had them. It also revealed we walk quite a lot as a band, whether people take it as a sport or not.

Participant 10 was enthusiastic about the fact that the Fitbit she wears allowed her to compete and that it encouraged her to increase her physical activity to win competitions. She said:

> I use it to go to the gym and, you know, track how many miles I run, um, there's a contest on the Fitbit app between me and my friends that . . . like . . . how many steps you could take a week, or how many miles you could walk in a day. I enjoy the little, tiny contests because, I mean, they don't seem like a big deal, but with the contests you're like, you want to walk this much more than your friend does

> and I want to beat them, and, you know, so, you purposely try to walk everywhere, or, at least, run on the treadmill or go swimming.

Several participants' intent with the use of WFT was to monitor the heart rate while performing physical activity. Participant 5 liked that the Apple watch was able to monitor her heart rate and interpret the difference between aerobic and anaerobic training, in which she labels cross-fit. She said:

> You can set it to where it will know you will be lifting weights, so, at that point, it will be recording your heart rate, and when your heart rate is like higher or something . . . and it will know when you're taking a rest. Sometimes I'm at the gym, and I want to lift weights, or I'm going to lift weights and run in between sets, or do cardio in between sets, you can do this thing like, it's called cross-fit, so you click the cross-fit one, and it'll know that your heart rate is going to be going up and down, depending on what exercise you're doing instead of just like assuming you're running the whole time, because if you're doing curls or something, your heart rate is not going to go as high as if you're doing sprints.

Participant 8 used the WFT to help improve her heart rate during physical activity. She said:

> In the past, I ran 5 K's every . . . like, every 5 K I could, every summer . . . and . . . I just like to see what my heartrate is, and how fast I can run. It shows you a scale of how healthy you are as you increase your heart rate or get better sleep. It shows you what your resting heartrate is lately and all those kind of things, and mine got better after I got my watch, like when I first started, I looked at it, and I

> was like, well, it's not that great, and then, I started working out 3 or 4 days a week for like a month, and it got better, and I was like, oh it really does work, that's cool.

**Theme 4: Health Risks Encourage Wearable Fitness Technology Use**

Theme 4 was developed from the following codes: perceived susceptibility, family and genetic health issues, personal health issues, and health issues in college females. The first central idea related to theme 4 generated from the collected data related to family heart disease, high blood pressure, cholesterol, and type 2 diabetes. Also, central ideas came from the participants' shared experiences with cultural overweight and obesity, individual health issues including ADHD, high heart rates, and type 1 diabetes. Lack of sleep was also a health issue for the participants. Experiences of the participants revealed that genetic and personal health issues promote the use of WFT (Table 5).

Participants anxiously talked about the genetic health issues in their families and experienced some vulnerability to unhealthy behaviors that could possibly lead to such diseases. Participant 3 was concerned about several diseases that was part of her family's history and culture. She said:

> Heart disease runs in my family. Obesity runs in my family . . . diabetes runs in the family . . . my dad has struggled with being overweight, like, his whole life. The heart disease and the obesity, the weight, and the diabetes are motivators for me to use the wearable to track my progress.

Participant 4 also had a concern with her family history of heart disease and type 2 diabetes and had the understanding that, although diabetes was prevalent in her family, she understood the disease is preventable. She also shared the experience of her great-grandfather having kidney disease and perceived susceptibility to disease kept her motivated to exercise. She said:

> There's some health issues in my family I don't want to develop. My great-grandfather had kidney disease, my grandmother had heart disease, my other great-grandmother had a massive heart attack, and, then, the grandmother who had heart disease also had diabetes. And, there's been other people in my family with diabetes, and my mom is pre-diabetic right now. I try to think, in the long run, you'll be healthier, you'll be happier, you won't have to worry about health issues down the road if I stay motivated and keep going with the physical activity. I think it (WFT) will make you work harder to get to that goal, then you'll feel better about yourself, so you'll want to continue to up the goal and continue to work at it, so you can prevent the issues, you know the diabetes and heart disease.

Participant 5 was extremely concerned about the genetic issues of heart disease and high blood pressure. She talked about the use of WFT and prevention of high blood pressure. She said:

> I know my grandparents have, not a lot, but they have like heart issues, and there's a heart monitor on the watch. Everyone's blood pressure is like really high, so I like will actually watch it. While I'm working out, I'll be like I want to watch my blood pressure, and if it's extra high, I'll freak out a little bit, but

> usually it's pretty good, I have a pretty normal blood pressure, so, I really watch that. The watch allows me to check my blood pressure, like, I know the lower, the better, that's all I know. So . . . I am aware that I have a family history of heart disease or high blood pressure, so it's one thing I use my watch for, you know, the prevention of getting blood pressure too high.

Participant 6 also discussed heart disease and high blood pressure as reasons for wearing the WFT. She said:

> I just use the Charge HR to measure my heart rate as I go throughout the day, sometimes it will spike, sometimes it will drop, I just have a general record of it. My dad's side of the family has high blood pressure, high chance of heart attack. All of my uncles have had a heart attack before 30. So, it's kind of strange I have low blood pressure.

The participants of the study had concerns about their own health issues and health issues that are prevalent in young college females. Participant 2 shared her experiences of how she uses WFT to help with the issue of sleep. She said:

> I really like that it tracks your sleep. Sleep is a big health issue for young college females and sometimes I can't sleep. I use the watch because I just wanted to know how many hours of sleep I'm getting because I'm never sure what time I actually fall asleep. Yeah, sometimes I can't sleep a lot, and I just wanted to know how many hours I'm getting because I'm never sure what time I actually fall asleep.

Participant 3 shared her health issues as she uses her WFT with the intent to monitor her heartrate due to her health issue of attention-deficit/hyperactivity disorder (ADHD). She also felt young college females could use the WFT to track sleep, essential for her health and cognition. She said:

> I get very high heartrates so it's good for me to have it to monitor my heartrate because I get past the zone I'm supposed to in workouts, and that's bad. So, I get, like, jittery and stuff, so I have to monitor it. So, when my heart rate gets to 180, it tells me to stop . . . you know . . . puts a light on, and it's, like . . . you don't need to run any more, or you don't need to do cardio any more, like, you can stop, and that's nice.

The intent of the use of WFT and heart rate monitoring and physical activity for Participant 6 was to help her with her diagnosis of postural orthostatic tachycardia syndrome (POTS). She said:

> When I stand, my heart rate goes really high, and this isn't for everyone, I have a weird version of what's called POTS, so my blood pressure plummets when I stand. The Fitbit HR is a beneficial tool for all of us (the POTS community) because we can tell if we're going to have too high of a heart rate.

Participant 8 discussed obesity and overweight as genetic issues for her family. She also stated that the being overweight and being obese contributed to other chronic diseases, such as high cholesterol, blood pressure, and diabetes. She shared concerns about weight as she had the same build as her mom, who was overweight. She said:

> One of my grandparents or great grandparents had like, high blood pressure, high cholesterol, those kinds of things. My family gains weight very easily. Like, my mom and I are built very much the same, and we have a lot of the same health issues (laughing). Um . . . but, like, my grandparents are overweight and stuff like that, maybe not over . . . well, overweight, yeah. And, like, my paternal grandfather is, like, extremely obese, and he has lots of health issues, that's where, like, the high cholesterol, blood pressure, that's where that comes from. The Fitbit, it's definitely a motivator. I believe that the Fitbit has an influence on that, on how you exercise and how you know, how you can avoid the family health issues.

**Theme 5: Wearable Fitness Technology is Educational**

Theme 5 was developed from the following codes: educational device and provides data for improved health. The participants found that many aspects of the WFT provided educational information related to their personal health and health issues in young college females. The following central ideas were used in the coding: encouragement and incentive for researching health-related data, education on realistic goal setting and healthy living, and educates young college females about the need for staying active (Table 5). Participant 3 shared her experiences with the use of the WFT and her thoughts on the device as an educational tool which led her to seek out research on her health. She said:

> I feel like this fitness device helps with education because you can hold yourself accountable for the stuff, you know. Like I said, you can choose the settings, and

> it teaches you to like, be mindful of how hard you work even, your work ethic. I think it's a motivator, not just for working out, but, I think it does push you to better educate yourself about your own health.

Participant 4 found an educational aspect in the use of WFT was to know how many calories she burned each day. She said:

> I think it does educate in a way just because, you know, most of the time, you don't know how many calories you burn in a day. So, therefore, if you wear the watch, you can look at the end of the day, oh I burned this, I'm out of calories, and this helps you, oh tomorrow, I might want to burn more, that kind of thing.

Participant 6 talked about the educational value of the WFT. She stated it educated her POTS community on how to react to high heartrates. She also talked about the effect this education has on long-term health benefits and preventive measures for her disease. She said:

> I can look at the heart rate throughout the night how much I dropped, so now if I stand, if it's going to be as big of a change, or if I overslept, is it something I need to take slowly, instead of just plopping up and going to take my medicine. It gives me the totals to let me know if it's going to be a good day or a bad day. So, for my Ehlers community, it's really a beneficial tool for all of us because we can tell if we're going to have too high of a heart rate, we need to sit down or if we're just going to have a bad day before it even starts and how to take the preventative measures to make it not as bad of a day.

The experiences of participant 7 and educational value of WFT was the aspect that the watch reminded her to get up and move. She said:

> I think it is educational because it even tells me to stand up every hour, which makes me think, oh, I need to get my blood circulating. I think about how it improves my health over the long run, not just for my workout, every day, too.

Participant 10 shared the educational value of the WFT related to sleep and the fact that the watch had taught her a lot about herself. She said:

> I learned, like, you know, how I sleep every night, um, I never knew how many steps I took in a day, I guess it's pretty educational because I have learned a lot about myself wearing the watch. It motivates you to want to learn.

**Themes associated with Research Question 2**

The second research question was, "What are young female college students' lived experiences with the use of WFT?" To address this research question and produce relevant responses to the lived experiences. Questions were asked related to personal health benefits of the use of WFT, experiences of individual physical and mental changes with the use of WFT, experiences with tracking, syncing, and sharing data related to health benefits, and barriers for young college females towards reaching their physical activity and nutrition goals with the use of the WFT. Themes 6 and 7 emerged from the participants' responses (Table 6).

Table 6

*Themes 6-7*

| Themes | Codes | Central Ideas |
|---|---|---|

| | | |
|---|---|---|
| Theme 6: Issues with Adherence | • Barriers in Adhering to the Goals<br>• Inaccuracy of WFT<br>• Inadequate Functions | 1. Time restraints<br>2. Counts movements inaccurately<br>3. WFT isn't waterproof<br>4. Doesn't stay charged<br>5. Struggling mentally to meet the goals |
| Theme 7: Increases Health Benefits | • Beneficial Physical and Mental Changes Increase Enthusiasm<br>• Tracking for Health Benefits<br>• Meeting Physical Activity Recommendations<br>• Syncing for Health Benefits and Positive Data | 1. Staying motivated leads to better health<br>2. excitement and independence<br>3. Tracing gives me a stronger perception and makes me more conscious of my personal health |

**Theme 6: Issues with Adherence.**

Theme 6 was developed from the following codes: barriers in adhering to the goals, inaccuracy of WFT, and inadequate functions. The central ideas for the coding were time restraints, counts movements inaccurately, WFT isn't always waterproof, WFT doesn't stay charged, and struggling mentally to meet the goals (Table 6). Participants of the study shared their experiences about the perceived barriers of the use of WFT and the barriers of not meeting the physical activity recommendations that affect positive health outcomes. Participant 1 felt that it was time consuming to continue to look at the data she had collected and continued to say the information may not be beneficial. She said:

> I just don't have enough time. When the data comes, it's like notifications or stuff, and at the end of the day, it will tell me how far I was. I don't look at it after that. I feel like I don't have time, and I don't know if it will be helpful to me if I looked at it. I don't know if it would be beneficial.

Participant 2 shared her experiences with the barrier of the WFT not being waterproof. She said:

> The only thing I don't like is when I wear it in the summer, I'm pretty active, and I'm always in a pool or, like, a lake, and it's not water-proof, so some days I know I'm going to be, like, around water, so I don't wear it the whole day, and it's a bummer.

Participant 5 described the barriers of why she did not meet the physical activity goals the watch sets as time. She said:

> I would describe the barriers for college students not meeting the goals the watch sets as time. And, I know that that's a common excuse is, like, oh, I don't have time to work out, and if you really wanted to do something, you would make time for it, and, yeah, I could go to the gym at 11 PM at night, but I would rather relax for an hour, and have, like, me time at the end of the day or something like that, it just doesn't, it's just not, it's just too much to try to do everything.

Participant 8 talked about the barrier to collect data from her Fitbit because she could not leave it on her wrist when she was near water. She said:

> A barrier for the Fitbit I have is it is not water resistant because I get in the shower with this one all the time . . . and, it usually happens when I'm washing my hair,

> and then, I'm like, and, like, rip it off, and, like, throw it out of the shower and stuff, and when I run in the rain, I'm, like, covering it up and stuff like that. And, I don't want it to get damaged, and, uh, even though it is sweat resistant and water resistant to a point, I don't want to intentionally put it out there.

Participant 9 shared her experiences with the inaccuracy of the Fitbit and stated this is a barrier for her. She said:

> Um, well, actually, I have a, like, a negative thing I would say about it, if well it could be a barrier. The thing that's, kind of, iffy sometimes is that when I was driving home, and I drive, like, I live 4 ½ hours away, I gained about a thousand steps just from just, like, sitting in my car, I was, kind of, dancing, like, it made me, kind of, think, like, I know I'm moving my arm and stuff, but it, kind of, makes me think, like, how many steps am I actually taking, and how many is just me moving my arms. It needs to be accurate, I know this is something like a barrier.

Participant 10 talked about the personal barriers to meet the goals set by the watch. She said:

> The whole idea of getting up and going, like, if the mentality isn't there, I feel like if more people had certain mentalities, like, they could look on Instagram and Facebook, like, see people high up and their friends, like, um, looking good, they're like, I want to do that, but I don't want to get up, it's your mentality that's, pretty much, the barrier. The Fitbit, like, it can tell you to get up, but you have to have the mentality to meet the goals.

**Theme 7: Increases Health Benefits**

Theme 7 was determined by the following codes: beneficial physical and mental changes can increase enthusiasm, tracking for health benefits, meeting physical activity recommendations, and syncing for health benefits and positive data. The central ideas used for the coding were: staying motivated leads to better health, excitement, and independence, tracking gives me a stronger perception and makes me more conscious of my personal health (Table 6).

The participants of the study shared experiences of the benefits of the use of WFT. Participant 2 conveyed her experiences of benefits of the use of WFT as a means of encouragement for physical activity requirements such as step and goal. She said:

> It encourages me to meet my steps and reach my goal and stuff, so I tend to, like, if my steps are low, I go out and do something, which, If I didn’t have the Fitbit, I would just not think about that.

Participant 4 shared the experience of how the use of WFT is beneficial to her self-confidence. She said:

> It definitely makes me feel better about myself because I see what is going on, what is happening, the calories I am burning, as many steps as I am taking. Obviously, you know, you think, I walked a lot today, but in retrospect, it actually shows you what all you’ve accomplished in that day, so I do feel it makes me feel better about myself. So . . . I feel better mentally, and physically, you know, the more I walk and the more calories I burn.

Participant 5 said the use of WFT was encouragement and increased her mindset for her to do physical activity. The excitement with the use of WFT and the fact that the watch takes all the guess work out of calculating calories and steps. These facts also encouraged her to tell her college friends. She said:

> It has definitely gotten me into the mindset of wanting to work out. It was really interesting to log each different thing and see, like you can set daily calorie goals, and see how many, there's like active calories, and just normal calories that you burn from just walking, and it's just really like, it was interesting to me to watch my exercise goal be complete and my active calories goal be complete. Not having to think about what I am doing helps me mentally and think better and I don't have to do any work the watch does it for me.

Participant 6 talked about how the use of WFT challenges her community to exercise which is beneficial to her health. She said:

> We usually have a couple groups that do walking challenges because exercise helps POTS, everyone knows that, cardio, specifically, low impact cardio, walking and elliptical or recumbent bike, those are the three they recommend, so it helps to kind of motivate us to get that exercise in and be able to see exactly what we have done.

Participant 7 shared how she experienced benefits of the use of WFT with a stronger perception of her personal health and feeling healthier both physically and mentally. She said:

> I honestly feel healthy when I balance, and I know I work out, and I eat right as best as I can, I feel right, and it shows in my body. If I apply this myself, then I know, and I can see it changing, like, if I have that mentality I'm doing ok, I can see my body responding to that. Personally, through the workouts I've seen me trying to reach the workouts on my watch. I feel having it keeps me mentally conscious of what I'm doing throughout the day. When I'm sitting down for long periods of time, I'll get up and walk for 10 minutes every hour, and I wouldn't think about it if I didn't have it, probably. In high school, I had a coach for sports, but I don't have one now, so, the watch is like my little mini coach on my wrist.

Participant 8 shared her experiences of many benefits of the use of WFT, such as how active she is from 9 A.M. to 6 P.M., which is the number of hours she has her watch set, her heartrate, and calories burned. She also felt it was gratifying to be able to collect and look back at the data from her Fitbit. She said:

> I love to look at how many floors and how many minutes active, and, it tells me my steps, my heartrate, the steps I've taken, like, you can set it for any amount of hours, mine's from, like 9 A.M. to 6 P.M., 250 steps an hour, and if you get all of them, you know, it's like, it turns green, and if you get your 10,000 steps and, you know, all your hours active, and, like, your floors, everything turns green, and it's like, oh, yeah, and your watch does a little thing when you reach 10,000 steps, and it tells you how many calories you've burned, and how many floors, and how many minutes active, so, I like to look at it. I think it's gratifying to be able to go back and look at what you have done.

The participants also shared their experiences of the use of WFT related to their personal health. Participant 1 said:

> I think, there are many health benefits for college girls with the use of the Apple Watch. I got it just to have as a watch to get my text messages, to see my activity, I just thought it would be an easier thing, but I really do like how it calculates all the workouts I do. It's a good invention.

Participant 2 experienced health benefits with the use of WFT related to her sleep patterns that have an effect on her health and her schoolwork. She said:

> Yeah, yeah, I can't focus during class when I don't get sleep, so the watch helps me know how much sleep I got . . . and sleep is beneficial to my health and my schoolwork.

Participant 3 experienced health benefits to the use of WFT with the ability to better understand how to track her nutrition. She said:

> So, when I got it, it really helped because once I got it, I started tracking my diet more. Tracking my diet made me eat better and I feel I'm healthier now.

Participant 6 shared experiences of the benefits the WFT has on her POTS disease and her sleep patterns. She said:

> It tells me how restless I am. I went for a time between the Charge HR and the Charge 2 HR, and I just find that I'm way more motivated and pay attention to my health with the watch.

Participant 7 felt that meeting her goals with the WFT was beneficial to her health. She also stated the fact the watch has a meditation function reduces the health issue of stress. She said:

> When I meet my goals, it is beneficial to my health. The watch also has meditation, which I use sometimes, it has a little meditation thing, which, if I stress out about school, it will do this little minute meditation, or I could do 4 minutes, just sit there and really center myself, which is really nice. I never thought I would really like it, I've never done meditation, but I really like that it does that kind of thing, and it helps, it will motivate me, alert me. Yeah, it will even say, if my heartrate has been up all day, it'll say breathe for a minute, and I'll be like, yeah, I probably should take a minute and stop.

Participant 8 has type 1 diabetes. She felt there were several health benefits with the use of WFT. She experienced not having to use as much insulin when she met the physical activity requirements that she had set on her Fitbit and she felt the heartrate monitor was essential for monitoring her health. She said:

> A benefit of the Fitbit is the heartrate part of it that I use. I can see it improve, get worse, and, you know, maybe, last week my heartrate was way higher walking the 4 flights of stairs to my apartment, and, maybe, this week it's not as high, you know, I do pay attention to that. Obviously, when I work out, I have to use less insulin, and I eat better, and therefore, my blood sugars are much lower.

Participant 10 shared her experience with the benefit of using the WFT related to how it helped her track her sleep. She said:

> I like the fact that I can track my sleep, so, I tried to sleep better. So, getting better sleep is a health benefit for me.

The participants shared experiences of syncing the data to an app on their computer or smart phone related to health benefits. Participant 2 talked about the syncing ability of the WFT and how it gave her gratification as she increased her physical activity. She said:

> I really like how you can sync it onto your phone, and go back, and, like, look at your progress, and know where you started, how many steps you were getting at first, and now how many I'm getting. It's really rewarding to look at the information you collected each day and see that you have increased your steps. Competing is good cause when I am behind, uhm, say like my mom has 6000 steps and I only have 5000, I'll just, like, go do another errand, run another errand, or do something really quick so I can at least get up to their level, and if not, get close to them. I'm more active when I see I am fourth in the competition with it.

Participant 3 liked the idea that the data could be synced and shared and found excitement that her online community that also used the Polar 360 wanted to do a workout that she successfully created. She said:

> There was a day when I created a workout for myself, and I was going to see if it is, like, a really good workout, and by the end of it, it was. It was, like, six hundred and something by the end of my strength training for calories, and the fat burn percentage. For strength training, that's a lot, so I was like wow, and that

wasn't including cardio, so I posted it that day, and I even said, this isn't even including cardio. And, people in my community in the app of Polar 360 were like, what . . . send me the workout you did. I was really proud that what I created for myself worked out so well.

Participant 4 experienced positivity in syncing the collected data because looking back at the information helped her push herself to do more physical activity. She said:

I continue to look at the data I sync because, like I said, it makes me feel better knowing, hey, you did this today, you didn't get here on this day, but on this day, you did, just to push myself more, and more, and more.

Participant 5 talked about her experiences with syncing the data as it created a means to be competitive and to reach her physical activity goals. She said:

I definitely like looking at the synced data and sharing with people because you can go on, I can scroll through all the people that want to share with me. I can see their activity goals, so I'm like "ha, ha" I'm about to beat this person, or I stood way longer than this person, and all that stuff, and sometimes I'll be getting ready, and I'm like I can't go to bed just yet because I need to get one more hour for my standing goal, so I will just like stay up a little bit longer to complete that goal for the day because it bothers me if I don't.

Participant 6 shared the experience of syncing data as a method to communicate with her primary care physician, so he could monitor her health. She said:

My doctor is actually on Fitbit, so, my PCP, she has access to all of the information as well, so she can monitor my health.

Participant 7 talked about the syncing capabilities of her Apple watch as a support system for those who were part of her community. She also talked about the competitiveness of trying to do as much as those people who were sharing in her Apple community. She said:

> I share with my best friend and a couple of my other friends, whoever has an Apple watch and are kind of synced up, and like, this person did a workout, which is nice because if they see it, they might think, they're doing a workout, I need to do my workout today, or they can reply and be like, great job, which is kind of cool. I've said, great job on your workout, looks like you did a hard workout, or just reply to them, and I think it's a nice little support system. Sometimes it does make me more competitive because I see some people have like a 600-calorie workout, and I'm like, oh, maybe I can do that, so I step it up a notch and do that, or I see someone has walked 12 miles, just an afternoon walk, if they weren't busy, and I'm like, I guess I could do that, too. It's not really me thinking about myself, it's me looking at other people, which I guess, can be good as a reminder, and motivation to be more active.

Participant 8 shared her experiences with syncing the data she collected into her My Fitness Pal. She also likes that she receives positive feedback and notifications when she has reached her goal. She said:

> So, every few days, I'll go and look, like review the past few days, or whatever, and your phone sends you e-mails and notifications of like, your weekly stats, and it'll tell you, like, how many days you hit the exercise goal.

**Themes associated with Research Question 3**

The third research question was, "What are the lived experiences of WFT use by young female college students and their intent for behavior change?" To address this research question and produce relevant responses to the lived experiences. Questions related to experiences in confidence, motivation, and adherence with the use of WFT to reach physical activity and nutritional goals were asked. Also, questions were related to the continual use of WFT, experiences with message alerts and feedback, the influence data has on health behavior, interactive capabilities of competing with WFT through social media, technological aspects of WFT for behavior change, and any experience that was a "wow" moment for them with the use of WFT. Themes 8 and 9 emerged from the participants' responses (Table 7).

Table 7

*Themes 8-9*

| Theme | Codes | Central Ideas |
|---|---|---|
| Theme 8: Recognizing Positive Feedback | • Competing Increases Self-Motivation<br>• Feedback Increases Self-Confidence<br>• Self-Efficacy<br>• Goal Achievements are Rewarding | 1. Feedback creates enthusiasm<br>2. Sharing goal attainment through social interaction increases self-efficacy<br>3. Positive feedback is enjoyable and self-gratifying<br>4. Online coaching creates awareness |
| Theme 9: Millennials Expectations of WFT | • Adherence<br>• Technical Capabilities<br>• Adequate Real-Time Feedback | 1. Likes the aesthetics, cost-effective, easy to use<br>2. Tracks sufficiently and accurately<br>3. Capable of meeting essential social interaction and provide feedback for instant gratification<br>4. Convenience of tracking calories<br>5. Data meets intellectual fulfillment millennials expect |

**Theme 8: Recognizing Positive Feedback**

Theme 8 was determined by the following codes: competing increases self-motivation, feedback increases self-confidence, self-efficacy, and goal achievements are rewarding. The central ideas for the theme were: feedback creates enthusiasm, sharing goal attainment through social interaction increases self-efficacy, positive feedback is enjoyable and self-gratifying, online coaching creates awareness (Table 7).

The participants shared their experiences with the use of WFT related to self-efficacy, as using the WFT generated self-confidence and self-motivation. Participant 1 stated that she found the WFT and the sharing aspect to be a basis for encouragement and self-motivation to complete more activity. She also talked about her experiences on how competing with her Apple watch with others gave her more self-motivation when she was able to reflect on the feedback of her daily accomplishments. She said:

> The wearable fitness band encourages me to do more activity than I would do . . . if I had not had it at all. I think sharing with people and seeing other people's healthy behavior makes me want to work out more. The activity rings, the notifications about standing up are motivating. I get medals, well not medals, but achievements, I get achievements when I finish things. I think there's a lot more self-motivation because I look down at it and see how far I am in my rings, and I hate that I'm not even half way, and that's what motivates me. When I finish my rings, I tell everybody about it because I'm excited that I did it, which means I met my goal that day.

Participant 3 talked about how she feels motivated when she shares her workout data with other users in her WFT community. She said:

> I do share my data and post it sometimes, at the end of a workout. If I feel really good, if I feel like I did a really good job, then I will post it. Sometimes when I post it, I've had people contact me afterwards, and be, like, oh, what's this watch, oh, my gosh, you need to send me your workouts. It's been like a motivator in itself to see people who want to do what I am doing.

Participant 4 shared her experiences with the use of WFT and how collecting the data made her feel better about herself and have more self-efficacy in her personal physical activity goals. She said:

> I feel really good and really confident in the ability to reach my physical activity goals. It makes me think, tomorrow you can do way better, you can do a lot more. It just makes me feel better about myself that I'm able to reach it. I think because everyone's competitive in their own way, and I think if you have a friend that's willing to work with you, to help you and help themselves, I think it will make you more motivated to get going more.

Participant 5 talked about how she felt more self-confidence in meeting her physical activity goals with the use of WFT. She also talked about the gratification of achieving her goals from the WFT messaging and from her friends. She said:

> Yeah, I definitely think it does give me confidence, and it really, some days I will be exhausted, everyone has those days you're just there and it's just not a good day, your just not doing good sets, and when I see my watch, I think wow, I did

> way more than I thought even though it was ridiculously hard. I just think, I just have a little more to go, so I'll just stick it out. And then, say like, I complete a goal, it'll like notify all my friends I share with and say congratulate her for completing this goal, then they can click back instant responses that say, "good job," "you crushed it," "way to go," really cute stuff like that, and that's motivating. I try to send it to everyone every time it comes up on mine because its encouragement. I feel really good and confident when I exercise, and I use the Fitbit. It also just makes me feel better, like its more enjoyable, happier, healthier.

Participant 5 also shared her experiences with how she was able to reduce her shyness and learn to be part of the WFT community that compete with each other. She said:

> The app only says just their first name, and you scroll, it will say like Josh did thousands of steps over here doing stuff, and you did this, and this is how you guys compare. And, I think that's really cool, and it actually opened me up, and kind of made me more comfortable, and I think it's much more easy for me to approach other people and talk about working out, different exercises, different goals, stuff like that because I'm training for the Pittsburg half marathon, and I had no idea where to start, and there was a girl running on the treadmill at the rec center, and I asked her do you have any tips because I see her on the treadmill every single day. She looks like a gazelle, so graceful and I asked her for advice. Before I wouldn't have done that at all.

Participant 6 reflected on the use of WFT and the instant feedback when achieving her goals as a way to increase her initiative to do more physical activity. She said:

> I really enjoy the fact that it rewards you if you go a week of meeting your goals, and that is enough initiative to get me to keep using the Fitbit and keep doing the exercises.

Participant 7 reflected on how she thought the WFT was like having a coach and gave her a sense of self-awareness and self-confidence to guide her through her workout. She said:

> The watch gives you like a lot of self-awareness and self-confidence, and keeping up with yourself because, like I said with a coach, you don't think about yourself as much if someone's guiding you so when you have the watch, it's kind of like your own guidelines and you follow your own rules. It is like you are your own coach so you, like, need to be really aware of what to do.

Participant 8 shared her experiences with the use of WFT and how the instant feedback on the screen is a form of self-motivation to increase her physical activity and meet her physical activity goals. She said:

> Seeing the feedback on my wrist on the screen is motivating. It's actually effective, you're watch (WFT), also, if you haven't done the 250 steps before the hour is up, 10 minutes before the hour, it tells you how many steps you have left, and, I've, actually, like, gotten up to finish the steps, and you . . . stay motivated and stuff. I bought it for a reason, to be a motivational device and, because I

> really do like seeing those kinds of things, and I like working out, and I like eating good, so, I was like, this is the missing piece to the puzzle. So, it is definitely a good visual, it's a good motivator. I adhere to the workouts, you know seeing those numbers, the instant feedback, is gratifying.

Participant 9 also talked about self-awareness with the WFT use. She also stated the WFT is a motivator to get up and move to meet her goals. She said:

> I would say, the watch keeps me aware of where I'm at with my physical fitness goals during the day, so, it gives me some self-awareness. I do like that I can compete with my friends, because I like competing, so, it is, kind of, like, a motivation for me to, kind of get more steps in, and try to beat people. Keeping track of steps, where you're at, seeing this on the screen, is a motivator. So, definitely the watch is for college girls to be more self-aware, like, encouraging them to get up and start moving.

Participant 10 also talked about how the use of the WFT brought up her confidence in meeting her physical activity goals. She said:

> Using the watch in general, I think it does bring up my confidence a bit because I'm like, oh, good, I'm burning these many calories, so, I'm going to, like I have this goal to make. Swimming tones your entire body, that's why I like to do it, and, so, like, I swam these many laps, and I'm feeling really good, let's go do this again tomorrow. Even running, I like to run, so, like, how many steps I take running, it made me feel a lot more confident in myself. I am a lot more confident because I know, like, I can physically see my goals.

Participant 10 shared her experiences about how she uses the WFT as a way to do something she loves, which is to compete. She reflected on how the use of the WFT increases her self-motivation. She said:

> So, I love to win, I'm very competitive, I love to be in first, if I don't get first place, I'm very upset. Seeing the data from my friends in my community on my Fitbit, it is like, great because it makes me feel like I can try to improve my motivation and win.

**Theme 9: Millennials' Expectations of Wearable Fitness Technology**

Theme 9 was developed from the following codes: adherence, technical capabilities, and adequate real-time feedback. The central ideas for the theme were: likes the aesthetics, cost effective, easy to use, tracks sufficiently and accurately, capable of meeting essential social interaction and provide feedback for instant gratification, convenience of tracking calories, and data meets intellectual fulfillment millennials expect (Table 7). The participants shared their experiences and gave detailed explanations for adherence and continual use of WFT. Participant 2 talked about her favorite features and she felt the habitual use of WFT was necessary to track her sleep. She said:

> At this point, it's probably like a habit, but I like having it, and it's just, like, nice to know because sometimes when I forget to wear it, I'm, like clueless how many steps I took, and it's, I don't know, it's nice to know how many steps you're taking a day. Also, my favorite feature on it is the sleep tracking thing.

Participant 3 also related her use of WFT to becoming a habit and something she would miss if she were to take it off. She said:

> Without it, I kind of feel, like, naked . . . I would never take it off if I had the choice because it's just something that I use every day, that I like there, it's beneficial to me. The one thing that doesn't meet the technological need for me is that I have to charge it, it dies, and when it dies during a workout, it stinks. I'd hate to go and leave my watch, like, that would be like the worst cake topper of that day, you know, if it was a bad day.

Participant 7 also talked about the inability of the watch to stay charged. She said:

> Things like charging it every night also get annoying because if I don't charge it, I won't have it the next day, and then I can't track my workout, even though I'll still go work out, it's still annoying because I like to have it every day. Having 1 day where it's not there really bothers me, but sometimes because it doesn't really stay charged, I just can't charge it.

Participant 4 shared her experiences with continual use of WFT as she explained she has a need to see the feedback for verification that she had met the step requirement. She said:

> Oh, like without the watch I don't know if I've walked 2,000 steps today or not even though you've done the same routine over and over, so I would continue to use it.

Participant 5 reflected on how the continual use of WFT and sharing the collected data helps her make better decisions related to her health. She said:

> I would say the sharing of data helps me consciously make better health decisions because I'm already thinking about my exercising and exercising and eating healthy kind of go hand-in-hand. You have the incentive to go work out in the morning, you're going to make better choices throughout the day.

Participant 6 shared that she needed to continue her use of WFT for extra documentation of maintaining a normal heartrate. She said:

> I need to just have that extra documentation if my heart is going crazy that day, it's just kind of there in the data.

Participant 7 talked about her love for physical activity and the adherence to the use of WFT because she can sync her calendar and workout schedule adds to her time management for her everyday life. She said:

> I like it because I like working out, that's just my thing. It's a watch and, since it's connected to my phone, it syncs my calendar on the watch along with my workout, and I think it keeps me a lot more organized with time management and when I can put my workouts in throughout my day. It'll tell me my calendar, and I'll say oh, I have 2 hours, I'm going to go work out, and it will track it and say I worked out in the day, I track it into my daily life.

Participant 9 reflected on her reasons for WFT adherence related to the need for being connected to technology. She stated the WFT needs to have text messaging and calls to be adequate. She said:

> I think, since we're in this millennial generation, definitely the text messaging and calls. I can't respond back to them, but it's nice to know when I get a message because if I'm in class and there's an emergency, I have it, you know, on my wrist where I can see it. The steps, that's another reason why I like to have it, because I like to know how active I am each day.

Participant 10 shared her experience with the use of WFT related to adherence as a way to reduce overweight and drinking in young college females. She said:

> You know, if more young college girls would get one there might be less overweight or, maybe, less drinking.

Several participants talked about the importance of the message alerts that their WFT sends them when they have either reached their goal or need to get up and move. Participant 4 discussed the message alerts in a positive way that encouraged her to move more and to drink more water. She said:

> The watch, it will vibrate every so often to kind of jolt you to get up and move around if you weren't actively doing anything. Sometimes I just looked at it, and sometimes I would actually get up and do something like put clothes away or something, just so I'd be moving. I think the constant reminder is good because a college student is so busy, and they have such a hard time focusing on more than one thing, especially if they're studying. When you look at the watch it tells you how much water you have drank that day, and I know there's times when I haven't drunk the normal amount of water that I usually do, and I start to feel

groggy and light-headed, so I know it affects me, and I can't imagine wanting to feel like that all the time, so that is really important.

Participant 8 reflected on how positive the message alerts were for her. She said:

> Um, it'll just say, like, congratulations, you have reached 10,000 steps or hey, like, you have, you know, 1,000 steps left to reach your daily goal. The message is always so positive, like, you really need that to reach your daily goal.

Participant 9 found that the message alerts was a great option on the WFT to keep her aware of her physical activity and push her to meet her goals. She said:

> I have message alerts, like, oh, you know, let's get up, or something, or it says something like that or says something like, let's try and make 132 steps, and, then, when you do it, it says, like, OK, great job. That was, actually an option to turn it on or off, and I put it on, just, also, to, kind of, keep me aware, you know, and it's also nice, I mean, I try to meet the goals every time.

Participants were asked questions about the gratification of the feedback. Participant 5 shared her experiences with completing her goals and believing the feedback was helpful. She said:

> It's just that it tells you that you accomplished something because I think a lot of people don't give themselves enough credit. I think that's why everyone likes seeing, hey, you completed this goal, you've completed something today, whether it's big or small, I think people just need to give themselves more credit, that's really helpful.

Participant 10 shared her experiences with the importance of the feedback from her WFT. She said:

> Even though I know I'm doing the same thing, you know, you look at what you have accomplished on the Fitbit and you think, now I know exactly what I have done. I like to see my results. I would rather see the feedback, so I know I'm actually going in the right direction.

The young college female participants discussed the technological aspects they thought were important for their generation. Participant 3 liked the personalization of the WFT and shared her ideas on what technological aspects were essential for her. She said:

> I think the heartrate monitor is necessary for sure. I think being able to choose which workout and tailor it to that helps as well. There's a sleep mode, there's an airplane mode, there's a Bluetooth mode. It's like personalized with your name in it. It has training, so it says my day, training, and then, if I hit training it shows all these different things, group exercise, Zumba class or something. And it tells me my heartrate, like right now it's 73 because I'm sitting. The steps, the sleep section is important. It has alarms on it, too. So, I think the technology on here is adequate for the millennial age college girl.

Participant 5 shared her experiences with the technological aspect of the WFT and shared one aspect that is frustrating to her. She said:

> The one I have right now, the only negative one I have is, it dies really fast, so I just get frustrated with it sometimes. I think it definitely needs the messages that remind you, hey don't forget to stand up. I think it needs to remind you to drink

> water. I have this thing on my laptop, and every time you open it up, it shows you this thing, a random positive message, and I think that would be really cute for your watch every couple of hours to say, hey . . . you're doing great today or something like that because it kind of just makes you feel good. Something motivational, something that makes you get up and smile.

Participant 7 discussed the importance of young college females' need for particular technology related to a nutrition app that could remind you to eat, and importantly an app for music to motivate her through her workouts. She said:

> I think maybe having a nutrition app on the watch, it's hard for me to eat all day, I might eat a meal in the morning and one at night, and then, I forget to eat during the day, so, something like, "oh eat your snack," or "eat your lunch." So, some type of visual reminder to eat. For the fitness aspect, definitely a workout app that displays both cardio and regular workouts. I like that it has music on it, too, that helps me with my workouts.

Participant 8 talked about the aesthetics of the WFT as a necessary part of wearing the band and how she felt it was well accepted for this generation as she was asked a lot about what type of band she was wearing. She did have a concern over the LED light that occasionally left a red mark on her and if this may be harmful. She said:

> Um, that it's, like, kind of stylish, like, I feel, like, cool that I wear one. A lot of people ask me, they're like, oh, which one is that, like, is that a Fitbit, is that an Apple watch? It has the interchangeable bands and stuff like that, so, you can, like, change the color of it and everything. It's like a conversation piece. It's

> weird because it does have a little laser thing on it, and I wonder if that's, like, harming my skin (laughing). Like, I'll sleep in it, and when I wake up I'll have a red spot on my arm, it's itchy sometime or sensitive, and I think it's because of the laser thing, but I don't really know.

Participant 9 also had some concerns about the technological aspect of the WFT in relation to nutrition. She said:

> If there were an easier way to log nutrition, like, maybe, if you could just snap a picture of food labels and it calculates, you know, that would be great and easy. Also, when I get a message, sometimes the whole message doesn't show up because it's too long, so, I feel like it would be better if it could show the actual whole message. Also, as millennials if the message alerts would use emojis (laughing). That would be fun.

Participant 10 discussed her ideas of the technological aspects millennials need even though she had a concern that some women only wear them to make a fashion statement. She said:

> Sometimes, I feel like some girls like them as a fashion statement. If the watch had a personal coach to tell me exactly what to do it would, like, be beneficial, and I would be like, yeah, wow!

The final question for the participants was sharing an experience when they first started using the WFT, and then after they had worn them for 6 months. Participant 1 shared her "wow" moment when she discovered the Apple watch allowed her to choose and collect data on numerous types of activity. She said:

> Yes, the Apple watch will automatically know, or you choose what type of physical activity you're doing such as, uhm, swimming or the Stairmaster, and it will monitor that for you and let you know what that is. Which is awesome!

Participant 3 shared her first experience with WFT and how cool it was to see the collected data. She said:

> I got it, and I wasn't around a gym, I had no gym membership. It was, like, winter, but I was in Texas, so it was still hot, it was like 80, and I did an old soccer workout with it, so I had a ladder and a bungee cord, and leg resistance bands for the ankles, and then, a trail to run, so I ran, and then, I did that, and I remember putting on the fitness watch, I was like doing weird forms of cardio, like burpees and stuff with the bungee cord on, and I was just like looking at it every five seconds and just like seeing what it was like, and trying to figure it out, and then, by the end of it when I saw it, I was just like, this is so cool, and I was so excited to wear it every day, I'm still excited after wearing it for 6 months.

Participant 5 reflected on how the technological aspect of her WFT displayed data for her swimming competitions. She said:

> I saw the watch on a Speedo commercial and I thought, that's really cool, so I got one. I put it on, and I started tracking my swimming, and when I did flip turns in the pool, I would always bring my hands in front of me and flip, so I'd be able to see on my watch through my goggles because it's bright, fluorescent, and very in your face. I'd be able to see my time, and I'd be able to go faster in practice, and I thought that was really cool because I'd never had something like that. I will

> keep buying them, I will keep wearing them until they are absolutely fried because I was one of those people, I thought, that's such a waste of money, and if you run a mile, you run a mile, you know that, but it's definitely given me a lot of incentive, it's definitely gotten me into a much better place, mentally and physically. I spread it to other people, and those people have spread it to other people, and I have this whole other community of people now. And, we do all these things together for each holiday, we get together and do a holiday workout, and I never had that before, like a different family.

Participant 7 also shared her excitement when she first started wearing the WFT with other people to encourage them to wear one. She said:

> I was amazed when I was able to monitor my heartrate. I really like it. I wear it every day, I make sure to wear it every day, and, I honestly recommend it to other people. It has the high intensity training (HIT), and I've used it a lot because it's a lot different than just the cardio thing. I encourage other students and people at work that they should try and get an Apple watch or watch with the fitness tracker, too.

Participant 9 talked about the technological aspects of when she first started wearing the WFT and her excitement with the customization of the interface and display of her Fitbit. She said:

> I liked that you could, kind of, set it the way you want, there was pre, you know, you could set, food, the time, you could change the preface of it, or how it was being on the customized things, so, I thought that was really cool, and, then, you

> can customize what shows up and what doesn't, so, again, on the customized thing, and, also, I just like what it showed, like, I loved the text, that it came up, and I liked being able to look at the steps at all times.

## Discrepant Cases

Morrow (2007) stated that discrepant cases involve a deliberate and articulated search for disconfirmation which helps to combat the researcher's natural tendency to seek validation of the emerging findings. This strategy of presenting the discrepant cases and discussing conflicting information adds to the credibility of the findings. The cluster analysis function that resulted from word frequency queries in NVivo Pro 11 helped me make comparisons and identify cases that were the least similar. Discrepant case for this study involved one participant's experience with the use of WFT being unrelated to her current or future health. This participant enjoyed looking at the data and was excited to share information with other users in her community; however, she stated that the data did not change the way she thought about her own health issues or those of young college females. All other participants shared their experiences of health benefits related to the use of WFT.

## Evidence of Trustworthiness

### Credibility

Lincoln and Guba (1985) stated that the aim of trustworthiness in a qualitative study is to support the argument that the inquiry's findings are recognized immediately by individuals who share the same experience and that there is trustworthiness in the findings. Credibility refers to both the truth of the participants' shared experiences and the researcher's representation of them (Cope, 2014). O'Reilly and Parker (2012) indicated credibility in qualitative studies refers partially to appropriate and adequacy in sample size. Additionally, O'Reilly and Parker suggest that the sample size must sufficiently answer the research questions, so saturation is met. Saturation was met when no new information was obtained.

The credibility in this study referred to the authentication and accuracy of the collected data which were personally attained from a sample of participants who all shared the phenomenon of the study. As a scholarly practitioner, for the study on young college females and the use of WFT, reflexivity was engaged during planning, conducting, and interviewing to promote a continuing relationship between my own subjective biases and the changing dynamics of the research process. Reid et al. (2018) indicated the researcher must be transparent in both their position and potential biases to manage ethical tensions in qualitative research. Researchers experience changes in themselves as a result of the research process and through reflexivity they can acknowledge these changes and how they may affect the research process (Palaganas, et al., 2017). Memoing was used in the study to capture thoughts and biases throughout the interviewing process and during the data analysis. All memos were typed and placed in NVivo 11 Pro under the node "Researcher Memos".

Kemparaj and Chavan (2013) suggest researchers use prolonged engagement to increase credibility in their study. They indicated that prolonged engagement is the investment of sufficient time in data collection activities to have an in-depth understanding of the participants' experiences. For the study of young college females and the use of WFT all participants were comfortable during their interview process which encouraged participants to share their experiences. The interview questions and probing responses provided rich, thick description and in-depth understanding. Also, to ensure credibility, optional member checking was implemented. The participants were given the opportunity to optionally review the transcribed interviews for accuracy and to acknowledge and respond to their own words and data analysis began.

**Transferability**

Transferability refers to the extent that the findings from the study can be transferred to other settings or groups (Kemparaj & Chavan, 2013). Quick and Hall (2015) suggest that transferability requires thick description of the research process and findings so other researchers can apply the ideas to their own work and settings or replicate a study. To ensure transferability in the study of young college females and the use of WFT, the findings provide a quantity of data that is rich, quality, and detailed. Additionally, to ensure transferability, a detailed description of the research methods and the characteristics of the participants for comparison to other populations was provided. All findings from the study were also reported and suggestions will be made so that the findings from this study could be tested by other researchers.

**Dependability**

Kihn and Ihntola (2015) indicated that dependability refers to the articulate, observable, and carefully documented research process that ensures that the findings of the study are consistent and replicable. Hence, dependability related to the degree of the researcher's ability to manage, understand, and analyze the collected data as they change throughout the study. To ensure dependability in the study, coding was tracked, memoing was used to track changes in the progress, and the need for coding and developing themes were understood. An audit trail was used to maintain researcher notes related to data collection and data analysis. For this study, interviews were transcribed verbatim into a Microsoft Word document and uploaded this data into NVivo 11 Pro. NVivo 11 Pro was a beneficial data management and analysis tool that increased the dependability of the study by aiding in researcher reflexivity and auditing findings during data analysis.

### Confirmability

Confirmability is the idea that findings are reliable and replicable (Connelly, 2016). Methods to ensure confirmability include methods that were used for transferability, including an audit trail of procedural memos and detailed notes of all decisions and analysis as it progressed. Interview transcripts were also offered to participants as an optional review for member checking. One strategy to improve confirmability of the current study was the use of memoing. Memoing allowed me to read and reflect on my own notes to ensure the experiences of the participants were their ideas and not my own. Also, to enhance the confirmability of the findings of the study, a thick, rich, in-depth report of the views of the participants which supported the interpretation of the study was provided.

## Summary

In chapter 4, the data collection process and the development of themes from participants' responses and data analysis were presented. Coding was also developed from verbatim transcripts. Tables to present the demographics of the participants, the interview schedule, and aspects of choice of WFT by each participant were provided. Additionally, in this chapter the process of the data analysis and the central ideas related to the codes and themes were explained. Evidence of trustworthiness for the study was and demonstrated through the explanation of how each research question was related to the themes. The data presented in Chapter 4 are a representation from 10 young college females and their use of WFT who attend colleges, technical schools and universities in a small city in northern West Virginia. The interviews explored the lived experiences of the participants and their intent for behavior change with the use of WFT. The participants shared their experiences with excitement and enthusiasm.

The finding reported in this chapter indicate that young college females use WFT for multiple reasons. The participants shared their experiences related to the use of WFT to collect data related to physical activity and aspects of nutrition including calorie counting and energy expenditure. Other findings show the use of WFT by young college females is self-regulation of their health behaviors to prevent health issues and as a motivational tool to help them increase physical activity. Also, the experiences of the use of WFT by young college females creates a community to connect to other people through social networking for encouragement and self-efficacy related to their health behavior and meeting their health-related goals. In chapter 5, the interpretation of the findings, limitations of the study, recommendations for further research, implications for positive social change, and the conclusion were discussed.

# Chapter 5: Discussion, Conclusions, and Recommendations

## Purpose of the Study

The main purpose of this qualitative study was to examine the lived experiences of young college females and their intent for behavior change with the use of WFT. Abraham, Noriega, and Shin (2018) stated that health behaviors throughout young adulthood are important, as they are likely to become health habits that continue into late adulthood. Because female college students have different characteristics and opinions about their health than male college students (Abraham et al., 2016; Colgan et al., 2016), the focus for the study was on females, 18-25 years of age, attending colleges in a small city in northern West Virginia, who had actively worn the WFT for a minimum of 6 months. Understanding female college students' lived experiences of intent for behavior change with the use of WFT is essential for reducing the health issues in this population. Adverse health consequences of risky health behaviors by young college females suggest the need for both research studies and age-related health prevention strategies such as technology-based approaches. On average, young adults 18-25 years of age, spend 11-12 hours of their day facilitating social interaction using some form of technology and view this as a regular resource for networking (Bauer, 2018). WFT has become the most popular and widely-used exercise devices to the point it topped the 2016 and 2017 American College of Sports Medicine Fitness trends (Farnell & Barkley, 2017). Farnell and Barkly (2017) suggested that, although there is evidence that WFT may promote physical activity, the research is limited. Rote (2017) concurred that although there are studies on the use of WFT, there is little research examining the use of these devices among college students, a population in need of a familiar and motivational approach to increase physical activity levels. The nature of this study was a qualitative focus with a phenomenological method based on semistructured, face-to-face interviews composed of open-ended questions. The use of phenomenology was appropriate, as I collected a detailed, in-depth description of the participants' experiences with the use of WFT through interviews. The constructs of the HBM allowed me to recognize issues that affect the health behaviors of young college females and their use of WFT. Therefore, this study contributes to the current literature on the use of WFT related to the users and in this study, young college female millennials and their intent for behavior change related to better health outcomes.

## Key Findings

The key findings from this study revealed the lived experiences of young college females and their intent for behavior change with the use of WFT attending colleges, technical schools and universities in northern West Virginia. Nine overall themes emerged from the data analysis. The themes were in alignment with the constructs of the HBM including perceived susceptibility, perceived benefits, perceived barriers, and self-efficacy and efficiently captured the perceptions of the participants related to health-seeking behaviors with the use of WFT. The data collected from the participants were analyzed and the following nine themes emerged: the importance of calorie tracking, awareness of WFT nutritional data, impact of WFT on physical activity, health risks encourage WFT use, education perception of WFT, issues with adherence, increases health benefits, recognizing positive feedback, millennials' expectations of WFT.

The study added to the body of knowledge surrounding behavior change and the use of WFT by young college female millennials. The phenomenological approach gave the participants the opportunity to describe their experiences with all aspects of WFT, including why they chose the brand they wear, which data they collect, how they sync data, who they share the data with, and their physical activity behavior change related to the WFT feedback. Participants discussed experiences that the WFT encouraged physical activity and how the real-time feedback challenged them to meet both their physical activity and nutrition goals. All participants in the study experienced increased levels of activity with the use of WFT.

The study also has shown that young college females recognize the need for the recommended amount of physical activity for positive health outcomes and the real-time feedback provides the visual data necessary for this millennial generation's needs. The knowledge gained from this study could be used for future studies on the use of WFT related to physical inactivity and unhealthy eating habits for this age group, as they are a technologically driven population.

## Confirmed Findings Related to Themes

### The Importance of Calorie Tracking

The first confirmed finding supported by the literature was that young college females use WFT for real-time tracking of daily energy intake, allowing them to self-monitor calories burned to meet their nutritional and physical activity goals. The participants of this study specified that the use of the WFT to track calories burned each day increased efforts to meet daily fitness goals. The participants described that the instant feedback of unmet goals related to energy expenditure encouraged them to increase their steps. Zhu, Dailey, Kreitzberg, and Bernhardt (2017) agreed that WFT encourages individuals to increase their physical activity through notification of data, specific to calories burned, enabling the user to reach or set even higher goals. Mercer et al. (2016) also indicated that WFT contains several behavioral change techniques including feedback that have been shown to increase physical activity.

Consistent in this study with previous research, the participants indicated that the instant feedback from tracking their calories encouraged behavioral change to reach their physical activity goals and the findings concluded that data feedback motivated some level of increased physical activity. Simpson and Mazzeo (2017) stated that both fitness and calorie tracking with the use of WFT provides motivation and opportunity to track caloric goals. They also specified that as young females are more likely to use WFT, there is an increase in understanding their use of WFT and behavior change related to energy expenditure and caloric intake.

The participants of this study understood that to increase energy expenditure and maintain a healthy weight or lose weight they had to increase the amount of time and intensity of their physical activity. Kreitzberg et al. (2016) indicated that WFT has been shown to effectively decrease body weight through self-monitoring calories. Participants of the study acknowledged and understood which activities resulted in higher energy expenditure, as one participant discovered that being a sprinter instead of a distance swimmer resulted in burning more calories. The use of WFT gave the students an easy tracking method to ensure the calories they were eating each day were equal or less then the calories burned. Church and Martin (2018) indicated that the contribution of energy intake and energy expenditure are influenced by each other and that higher levels of activity are noted by a healthier body weight. Ravussin and Ryan (2018) agreed that being overweight and being obese occur when energy intake exceeds energy expenditure over time. The perceived severity of high incidence of being overweight and being obese in young college females, which often occurs during tertiary education (Jiang, Peng, Yang, Cottrell, & Li, 2018), motivated the participants to meet physical activity goals set by the WFT.

**Awareness of Wearable Fitness Technology Nutritional Data**

The participants of the study revealed that the ability to sync data to a nutritional app helped them make healthier choices and that nutrition apps were an exciting form of technology to log healthy food. Chen, Zdorava, and Nathan-Roberts (2017) reported that individuals like the concept of the features in nutrition apps such as calorie and nutrient recommendations and that the app provides a useful accountability tool for the awareness of nutritional data and nutrition behaviors. The use of the fitness app linked to their WFT, such as My Fitness Pal, provided the participants with self-awareness of important nutritional data related to calorie count and nutrient breakdown. Additionally, perceived benefits of the fitness app provided the participants with the resources to make healthier choices in daily nutrition.

My Fitness Pal is an app that allows users to track nutrition by scanning barcodes, searching the food database, viewing total daily intake, and viewing macronutrient values and has become an increasingly useful method for gaining nutrition knowledge to its users (Evans, 2017). Chen et al. (2017) agreed that the ability of WFT to track and sync calories to a food log impacts the users' behavior in positive food decisions and healthier outcomes. The participants found the accessible platform of the My Fitness Pal app and other food apps for recording their nutrition as motivational tools that encouraged healthier eating behaviors. One participant who had type 1 diabetes felt it was a valuable tool for scanning bar codes that allowed her to reduce the number of carbohydrates that spiked her blood sugars. Lieffers, Arocha, Grindrod, and Hanning (2018) reported that the food log apps synced from WFT can provide support including self-monitoring and social support.

**Impact of Wearable Fitness Technology on Physical Activity**

A finding for the study was that the use of WFT by young college females increased self-awareness of their physical activity goals by the devices' ability to display instant feedback. Participants tracked physical activity and received instant data of step count, cardiovascular training, and strength training. Jones, Seki, and Mostul (2017) stated that college students track step counts and feel that the feedback makes them more aware of the need for increased activity.

Reaching goals and competing with their community of friends and family motivated and encouraged the participants of the study. Participants stated that they could enter competitions through their online WFT app and felt these contests made them more aware of the level of activity necessary to win. Zhu et al. (2017) indicated that WFT allows users to compete through a social media platform that shows visual details of competitions and benefits users by sharing their data and receiving encouragement, support, recommendations, and feedback from family, friends, or fitness experts. The participants revealed that they communicated data from their WFT through face-to-face, traditional technology such as iPhones, and social media including Facebook and Instagram when competing with their community. Chen et al. (2017) stated that social WFT communities allow users to share data though social networking features and are influenced by others achieving their goal making them more likely to do the same.

Motivation, self-awareness, and self-efficacy of physical activity goals increased with the use of WFT by the participants in the study. Hartman, Nelson, and Weiner (2018) stated that WFT makes self-monitoring less burdensome and seeing the data can be a motivating factor for increasing physical activity. Maher, Ryan, Ambrosi, and Edney (2017) agreed that WFT motivates users to improve their health by increasing their physical activity.

The participants stated that the use of WFT was an important tool for monitoring heart rate while tracking aerobic and anaerobic training. Zamrath, Pramuditha, Arunn, Lakshitha, and De Silva (2017) specified that WFT is now becoming the new trend to monitor not only physical activity but enables individuals to monitor their heart rate. Yavelberg, Zaharieva, Cinar, Riddell, and Jamnik (2018) stated that WFT that track and differentiate physical activity intensities by monitoring heart rate aids in self-efficacy, engagement, progress that leads to meaningful gains, and self-confidence in physical activity skills. Heart rate monitoring during physical activity with the use of WFT has been shown to increase knowledge about the level of intensity as well as the instant feedback used to meet those levels (Dooley, Golaszewski, & Bartholomew, 2017).

The heart rate monitoring feature of the WFT was also a beneficial tool related to perceived susceptibility for preventative measures to improve resting heart rate and the instant feedback of the heart rate monitor was used to better understand when to decrease the intensity of the physical activity when the heart rate exceeded the safety zone. Dooley et al. (2017) reported that monitoring heart rate with the use of WFT to lower heart rate during recovery is associated with an increased overall well-being. One participant, who had POTS, used the WFT as a beneficial tool for monitoring her heart rate as a method of health prevention.

**Health Risks Encourage Wearable Fitness Technology Use**

Participants revealed that genetic health issues and perceived severity of family health issues were determining influences in their decision to wear and track physical activity data with the use of WFT. For the participants in the study, WFT offered a promising opportunity for self-monitoring physical activity, a key element for successful behavior change, and the prevention of chronic disease. Phillips, Cadmus-Bertram, Rosenberg, Buman, and Lynch (2018) suggested that when young females are attending college it is the favorable time to integrate data collected from WFT for chronic disease research and management within health and epidemiological promotion, including monitoring and assessing physical activity to understand frequency, intensity, and duration, and as a tool to facilitate physical activity behavior. The participants in the study experienced genetic health issues that they felt increased their vulnerability for chronic disease. Heart disease, high cholesterol, type 2 diabetes, and obesity were all diseases that the participants felt could be reduced or prevented by the increase of physical activity. One participant talked about the use of WFT as a motivator to track progress and reduce her family health issues of heart disease, obesity, and type 2 diabetes. Zhang, Luo, Nie, and Zhang (2017a) stated that health beliefs of young females significantly influence the awareness of the usefulness of WFT.

Participants indicated that WFT motivated them to continue to work towards their goals to prevent family health issues. Two participants whose families had health issues related to high blood pressure and heart attacks used the WFT feedback to manage and control their blood pressure during physical activity. Sidhu et al. (2017) indicated high blood pressure is normally prevalent in older populations; however, young active adults are not free from the disease. They stated that family history of high blood pressure is an important risk factor since about 30% of blood pressure variance is attributed to genetic factors. Tran et al. (2017) concurred that young college females are vulnerable to genetic risk factors for high blood pressure and self-monitoring with the use of WFT gives this population an opportunity for prevention.

Participants stated that sleep monitoring with the use of WFT was an essential tool and that they believed that most young college females struggle with sleep issues. Baron et al. (2017) stated that WFT that contain sleep monitoring capabilities are rapidly growing in popularity and give individuals a familiar method for tracking sleep. Baron et al. indicated that sleep is reported as the most interesting health measure to automatically track and can be used for sleep behavior change. Thygerson (2018) specified that adequate sleep for young college females is an important facet for maintaining health and that adequate sleep reduces stress. He also stated that monitoring sleep habits with the use of WFT can help young college students identify unhealthy sleep patterns and work toward improving their sleep habits. Herrmann, Palmer, Sechrist, & Abraham (2018) indicated that college students did not get the recommended number of hours of sleep each night, which negatively impacts their health and well-being. Hermann et al. reported young college females ages 18-25 should get 7 to 9 hours of sleep each night. Participants stated that the perceived susceptibility of health issues related to lack of sleep was a significant factor in maintaining good grades. The participants indicated that they had trouble focusing in school when they did not get adequate sleep and that sleep was beneficial to their health and their schoolwork.

**Wearable Fitness Technology is Educational**

The participants in the study revealed that some aspects of WFT provided them with education and increased self-efficacy related to their health. Participants were encouraged to investigate additional information related to the data collected by WFT. Chen et al. (2017) concurred that WFT provides education on goal setting to encourage behavior change. Participants found that WFT was educational within their social communities such as learning healthy behaviors from others who had the same health issues. Chen et al. stated that WFT users can potentially learn from their online community such as what to do when their heart rate gets too high or when they have low blood sugars. Düking, Holmberg, and Sperlich (2017) agreed that the use of WFT can educate and provide guidance and feedback to the user on specific recommendations for physical fitness training. The participants of the study found that WFT feedback educated them on calorie intake, mindfulness of how hard they worked, and visual reminders to get up and move.

**Issues with Adherence**

The participants of the study indicated that perceived barriers were related to their experiences with several issues of adherence to the goals set by WFT. Although the initial notification and feedback of daily physical activity, heart rate, calories, and energy expenditure were acknowledged by the participants, they noted that they did not have time to look back at the collected data past the initial visual display. Some participants felt the data were overwhelming and that it was too time consuming to look back at previously collected data, including weekly and monthly data. Lewis, Napolitano, Buman, Williams, and Nigg (2017) indicated that for WFT to be a successful tool for behavior change it is important that the content of the apps be tailored to the population's needs. Coorevits and Coenen (2016) agreed that accessing data from WFT should be easy and provide the users with feedback tailored to their activity levels, provide reminders, and compare accomplishments in real-time.

Additionally, related to perceived barriers, the participants of the study also talked about not meeting the goals set by the WFT due to lack of time. The responsibility to homework, work, and social activities limited the amount of time the participants had to meet physical activity goals. Although sharing and syncing data with their communities was their personal choice, two of the participants stated they felt obligated to respond to others to congratulate them, and this took time away from meeting their own physical activity goals. Abdullah, Yusof, Nazarudin, Abdullah, and Maliki (2018) suggest that physical activity goals are defined as leisure time activities that do not always come first for young college females who are attending higher education. Acampado and Valenzuela (2018) concurred that young college females are stressed due to time-related issues which leads to physical inactivity. Venn and Strazdins (2017) agreed that lack of free time has a relevant influence on young college female behaviors related to physical activity.

Five of the participants acknowledged an issue to adherence as their choice of WFT did not stay charged. Perceived barriers were also confirmed as the participants stated that when the WFT lost its charge they were unable to track their work out and see the visual feedback of goal completion, discouraging them from finishing their work out. Wen, Zhang, and Lei (2017) indicated that a main issue with the use of WFT is the short battery running time and that users must foster the habit of continuous wear and regularly charging the device. Dehghani (2018) concurred that low functionality and limited battery life are issues of adherence for young college females use of WFT. Michaelis et al. (2016) indicated negative experiences, such as poor battery life, impacts the users' experience and discourages them from meeting and adhering to the physical activity goals.

Participants revealed that inaccuracy of WFT data monitoring also was an issue to meeting their physical activity goals. One participant talked about arm movement being counted as steps as she traveled in her car and questioned how she could determine the actual number of steps versus the arm movement. Wen et al. (2017) stated that manufacturers of WFT need to increase accuracy and reliability of WFT data monitoring such as accurately recording the targeted behavior and giving accurate feedback to improve the user's intended behavior and reduce barriers to adherence. Chang, Lu, Yang, and Luarn (2016) indicated that young adults primarily use WFT for fitness improvement and accuracy is an important component.

Additionally, the participants confirmed they could not wear their WFT 24-hours a day due to their brand was not waterproof or resistant to water. For those participants whose activities including swimming or water sports, taking the WFT off reflected lower daily totals. Two of the participants talked about low adherence to the goals set by the WFT due to this issue. Four of the participants talked specifically about their disappointment and the perceived barrier related to this issue and stated that not being able to be connected to their WFT made it more difficult to stay focused on physical activity goals. Coorevits and Coenen (2016) noted that for WFT to successfully change the intended behavior, the wearable should have a high degree of resistance to all types of wear.

**Increases Health Benefits**

The participants stated that the real-time feedback encouraged them to increase their level of physical activity when they had not met the goals set by the WFT; they perceived this as beneficial to their health. They noted that accomplishing their daily physical activity goals boosted their self-confidence and self-efficacy for achieving healthier outcomes related to health prevention. The participant with type 1 diabetes and the participant with POTS found the WFT a beneficial tool for managing their diseases that increased health benefits. Wortley et al., (2017) stated that a key construct of self-care management to receive health benefits is self-monitoring and WFT enables users to monitor their behavior and track their health data in an easy and opportune way.

The participants of this study indicated that the perceived benefits from the feedback of WFT data increased health benefits such as better mental cognizance and physical stability. One participant used the meditation app of her WFT to reduce stress levels. Wortley et al. (2017) indicated that collecting and self-analyzing data from WFT is meaningful to young college females both psychologically and behaviorally. Fotopoulou and O'Riordan (2017) agreed that the use of WFT can improve various aspects of personal life, including mood, physical performance, and mental performance. Wortley et al. indicated that although WFT tracking promotes self-care and self-efficacy, it is essential that young college students stay motivated for long-term health and well-being. Gresham et al. (2018) noted that WFT has a strong potential towards improved health benefits and long-term, real-time monitoring of an individual's well-being is essential for reducing health risks.

One participant, who had POTS, stated that she synced and shared the data she collected from the WFT with her primary care physician, so he could better monitor her heartrate and her overall health. Miller (2017) stated that the perceived benefits of the use of WFT is useful as an adjunct to treatment by healthcare professionals. He indicated that the data which is synced and shared to health professionals is significant and beneficial for behavioral compliance and behavioral change in individuals with health issues. Zeng and Gao (2017) agreed that primary care physicians can monitor a patient's compliance to recommended physical activity, heartrate and sleep, through the use of

WFT. Zhu et al. (2017) also specified that WFT can be persuasive in targeting a specific behavior if there is a social support and social connectedness for personal health monitoring. Sanders et al. (2016) indicated that as more healthcare providers in the United States are moving to a value-based care system, technologies such as WFT that provide data to promote health and wellness by engaging in healthy behaviors will have the potential to be an integral resource for healthcare providers.

**Recognizing Positive Feedback**

Feedback from WFT increased self-motivation, self-confidence, and self-efficacy for the young college females in this study. The instant feedback, notifications, goal rewards such as medals, badges, or activity rings that appear on the user's interface recognizing a variety of achievements to help users celebrate victories along their health journey, coaching, and sharing capabilities of WFT for the participants motivated and encouraged them to make healthier eating and physical activity choices. Mercer et al. (2016) stated that WFT is a simple tool that promotes self-confidence when self-monitoring physical activity. Fotopoulou and O'Riordan (2017) indicated that the feedback displayed on the screen of the WFT is motivating and although checking collected data can be a tedious activity, the rewards and positive affirmation of WFT encourages self-efficacy of users taking responsibility for their health. Kappen, Mirzq-Babaei, and Nacke (2017) agreed that motivational affordances are made possible through the feedback of WFT.

WFT provides a greater self-awareness and self-efficacy for the user and that most young adults find self-tracking and real-time feedback enjoyable (Chum et al., 2017). Self-tracking with the use of WFT can enhance self-awareness as young college females better understand necessary choices of daily physical activity (Schüll, 2016). Peer motivation contributed to increased physical activity and the participants in this study found that comparing results with others inspired them to have greater self-efficacy related to their physical activity. The notifications provided by WFT were also self-motivating as the participants talked about completing their rings and receiving badges and rewards for meeting the activity goals. Chang et al. (2016) noted that virtual rewards, achievements, and social connection to competing in the WFT community are effective ways to increase motivation and achieve physical activity goals. The participants confirmed that the positive and motivational messaging from the WFT also encouraged them to do more activity. Not only is the feedback when the physical activity is accomplished significant, receiving messages when the user is inactive as a reminder is also important and relevant for self-efficacy of managing physical activity (Sanders et al., 2016).

The participants of the study revealed that they liked being connected to technology as the use of WFT became an automatic habit that increased self-confidence related to their physical activity. They also liked the concept of having increased control and self-efficacy over their everyday activity monitoring. Becker, Kolbeck, Matt, and Hess (2017) stated that WFT has been shown to increase a users' willingness to reach their fitness goals, intensify self-confidence, contribute to their own health, and facilitate preventive health care while becoming a daily habit. Habits are created when rewards and motivational reinforcements of the desired behavior are facilitated through the use of WFT (Canhoto & Arp, 2016).

**Millennials' Expectations of Wearable Fitness Technology**

For WFT to be successful for the millennial generation, it has to interpret data while delivering valuable insights and be unpretentious and easy to use. Buyers of WFT seem to care as much about the design as they do the functionality of the product (Mehdi & Alharby, 2016). The young college females in this study stated WFT must have a pleasing aesthetic design, help achieve specific health behaviors, have entertaining apps and features that reward frequent use for instant gratification, and meet social interaction capabilities. The participants of the study stated that perceived benefits of the use of WFT would be the additional aspects that the millennial generation needs including the ability to see text messaging and phone calls on their WFT, more consistency in positive messaging, reminders for meal, snacks, and water, familiar messaging using emojis, easier technology for logging nutrition, and access to personal coaching.

## Disconfirmed Findings

A review of the literature suggested that young college females are affected by a rapid rise in type 2 diabetes (Casagrande et al., 2016). Additionally, Gooding et al. (2016) stated that 1 in 5 young adults have abnormal cholesterol and have a low-density lipoprotein cholesterol level that would require pharmacologic treatment. For this study, none of the participants had type 2 diabetes or an abnormal cholesterol level. The literature indicated that hypertension affects approximately 1 in 6 young adult females, creating generational health burdens for cardiovascular disease (Johnson et al., 2016).

Only two of the participants had issues with high heart rates or high blood pressure; however, neither had a diagnosis of hypertension.

## Theoretical and Contextual Interpretations

The HBM is a theoretical framework that is used in social science research to predict health-seeking behaviors (Jones et al. 2015). The constructs of perceived susceptibility, perceived threats, perceived benefits, perceived barriers, and self-efficacy were confirmed in this study. Perceived susceptibility for the young college females were related to family and genetic health issues, such as heart disease, high blood pressure, cholesterol, and type 2 diabetes. The participants talked about their genetic health issues and how the perceived susceptibility of their family health history encouraged them to choose WFT to meet the recommended physical activity goals for healthier outcomes, consistent interactive physical activity, and prevention of unwanted family health issues. The vulnerability to family diseases also increased self-efficacy to reach the recommended physical activity for young college females.

To reduce perceived threats, young college females must believe that increasing their physical activity will be effective and that the benefits of the new behavior will outweigh the effort to reach their new physical activity goals (Esparza-Del Villar et al., 2017). Perceived threats of young college students including high stress and being overweight and being obese; these threats encouraged the participants to increase physical activity and make better choices in daily nutritional needs. Young college students perceive inadequate sleep as a threat to their health and academic performance Adriansen, Childers, Yoder, & Abraham, 2017). The students of this study indicated they also perceived lack of sleep as a threat to their health. The participants increased self-efficacy with the use of WFT as the tracking of sleep motivated them to try and improve their sleep behaviors.

Perceived barriers were also acknowledged in the study. The participants shared their experiences of the perceived barriers with the use of WFT. Barriers cited were lack of time to reach daily goals, the WFT does not stay charged, the WFT is not resistant to water or is not waterproof, inaccuracy in tracking step count, and not always being mentally able to reach their goals. Perceived benefits of the use of WFT were related to meeting physical activity goals to reduce and prevent health issues and motivating the participants to be more conscious of their personal health. The participants of the study talked about the excitement and enthusiasm of tracking their daily activities and stated the instant feedback encouraged them to meet goals they may not have attained without WFT. They also confirmed the feedback of data increased self-efficacy.

Education allows individuals to recognize perceived risks and perceived benefits encouraging young college students to engage in health-enhancing behaviors (Yang, Luo, & Chiang, 2017). Perceived benefits with the use of WFT for this study included the ability to track and monitor heart rate. The participants stated that monitoring their heart rate was beneficial to their overall health and increased self-efficacy. The perceived benefits of the study were also identified as motivating factors to use the collected data from WFT to make more conscious and healthy decisions related to their health. The educational aspect of the data collected from WFT also addressed perceived susceptibility and enhanced self-efficacy. The participants recognized that WFT was an educational and familiar technological tool for physical activity goal setting and the rewards for staying active increased self-efficacy. The participants confirmed that competing with friends and family while using the WFT increased self-motivation and self-efficacy. Friendly competitions within their community gave the participants an incentive to increase their personal physical activity goals to win.

The use of this theory allowed me to examine young college females' experiences of WFT and perceived severity and perceived susceptibility of health inequalities. The HBM's construct of self-efficacy reflected confidence and motivational behavior of the use of WFT by young college females. Perceived benefits and perceived barriers of the use of WFT provided insight in identifying data to design effective interview questions and collect valuable data related to young female college students' health-related behaviors; therefore, the HBM was significant for the study of young college females and the use of WFT.

## Limitations of the Study

The study has several limitations. A purposive sampling method was used in the phenomenological study of young college females making generalizability of the study limited to this sample population. All of the participants attended a college, technical school or university in northern West Virginia, and were volunteers who met the study's criteria making the findings not generalizable to college females from other colleges or universities or those who were younger than 18 or older than 25 years of age. The data analysis was subjective and the results from the study may not be representative of all young college females. Hays et al. (2016) stated that credibility for qualitative studies should also include sampling adequacy. Saturation was reached with a small sample size of ten participants and was appropriate for gaining in-depth information related to young college females and their intent for behavior change with the use of WFT; however, it does not allow generalizability of the findings.

Additionally, a limitation for the study was potential researcher bias. To reduce potential researcher bias for the study because I own and operate a fitness facility and have experience with physical activity, nutrition, and WFT, my Garmin WFT and physical activity attire was not worn. Although a professional and unbiased relationship was established for the study, the participants may have known that I organize and participate in numerous physical fitness and health-related activities in the running, cycling, and swimming communities in the city I reside and their opinions and responses to the interview questions may have been influenced by this prior knowledge.

## Recommendations for Further Research

The association with the use of WFT to engage young adults in health-related interventions has been identified as a significant area of upcoming research (Lytle et al., 2016); however, most research studies have been quantitative (Bice et al., 2016). Therefore, further research should be qualitative in nature to gain more in-depth insight of the experiences of young college females and their intent for behavior change with the use of WFT. The study revealed significant data related to several aspects of the use of WFT including step tracking, nutrition logging, sleep tracking, heartrate monitoring, syncing collected data, and competing; however, there was a small sample size and was conducted in a small rural community. Additional qualitative studies could be conducted by recruiting a broader population sample of young college students from universities in larger cities and rural areas in other parts of the country.

Future studies for this population and the use of WFT should focus on health issues that were exposed in the data analysis related to young college females including asthma, attention-deficit/hyperactivity disorder (ADHD), type 1 diabetes, and postural orthostatic tachycardia syndrome.  Future research might reveal different outcomes if the study is conducted with a population that is inclusive to young college female students whose college majors include physical activity or nutrition courses.  Two of the participants in the study acknowledged they had a greater understanding of the amount of physical activity and essential nutrients for healthier choices and healthier outcomes due to health education being part of their major.

The length of time the participants of this study used WFT varied from 7 months to 48 months.  Future studies are also needed to bridge the gap between young college females who are novice users and those who have been using the WFT for longer periods and have more expertise.  The study revealed that participants who had used WFT for a longer period of time indicated their plan was to continue use of the WFT and find more ways to incorporate the data into their health behaviors.  Some of the participants who were novice talked about not being able to adopt all the functions of WFT.  Perceived usefulness is necessary for continued use so young college females can experience increased health benefits.  Researchers could conduct further studies to better understand the usefulness of both novice and expert users related to WFT.

## Implications of Positive Social Change

Positive social change is the process of transforming behavior, social relationships, institutions, and social structure to generate beneficial outcomes for individuals, families, communities, and organizations (Stephan, Patterson, Kelly, & Mair, 2016). College students experience many new social changes including high amounts of stress, physical inactivity, and changes in sleep and eating habits (Dexter, Huff, Rudecki, & Abraham, 2018). Findings from this study highlight the importance of developing successful health prevention strategies to increase physical activity and to prevent or improve health issues in young college females.

Awareness of the health behavior of young college females with the use of WFT could help college health service practitioners recognize health prevention strategies related to this technologically-advanced generation. As WFT has gained a new level of popularity among millennials towards increased motivation, self-efficacy, and higher levels of recommended physical activity, I plan to contact the student health services at the two colleges and technical school in which the participants attended and offer to do a presentation on the findings of the study. The development of a relationship with community college partners will allow me to disseminate findings that could potentially influence and impact the health and well-being of the college students in this area.

The findings of this study show there is a trend toward self-efficacy, increased motivation, and educational value with the use of WFT by young college females. Contacting the School of Public Health at the college, technical school and university and offer to do a presentation of the findings of the study could be beneficial for positive social change for the college population. As the nature of college offers a unique opportunity for promoting skills that assist students in education related to managing health behaviors, providing the findings in a presentation, including the addition of WFT to traditional resources such as textbooks in college courses related to health education or nutrition classes could be advantageous for positive social change. This may be an effective and enjoyable strategy to increase physical activity among college students in the United States (Roth, 2017).

The findings of the study might be used as a tool to advance WFT syncing and sharing capabilities with primary care physicians related to the health of young college females. Haghi, Thurow, and Stoll (2017) indicated that WFT can be used as a self-health monitoring tool when integrated with telemedicine and telehealth efficiently. The local primary care offices in northern West Virginia could also be contacted to present the findings of the study, so they could better understand this age and gender related to self-monitoring and sharing data concerning their health. One participant was currently sharing her collected data with her primary care physician related to her heart rate monitoring to manage her disease. Ilhan and Henkel (2018) stated that collecting and syncing data with health care professionals could improve and support self-management of health behaviors. The findings of this study suggest young college females are willing to share their collected data for health prevention and health management. Contacting West Virginia University Hospital to reveal the findings of the study will also be implemented. The hospital has an online website including a health library which individuals can access credible information related to their health. The study could be used by this institution to disseminate data related to WFT and the health behavior of young college females.

Additionally, the study's findings show WFT offers a technologically familiar method for young college females to self-track and join online social communities for encouragement to form better habits related to their health. Social media forums such as Facebook, Instagram, and Twitter, and WFT companies such as Fitbit, Garmin, Polar, and Apple may also find the study important for developing future models of their trackers specific to young college females. A professional and educational letter will be generated to offer WFT companies the findings of the study to see if they would be interested in receiving the results of this study. Because the millennial generation tends to show a high level of interest in their health and well-being, some due to the availability of WFT and related apps, they can self-monitor daily activities, enjoy rewards for completing goals, compete with friends, increase physical activity due to reminders, better understand nutrition, and enjoy being connected to technology while they are doing it. WFT companies could possibly use the findings of this study to design their new WFT models with this population in mind.

## Conclusion

College students are entering an independent and self-accountable age that adds emotional stress when managing their health behavior (Reifman et al., 2016). Young college students have poor eating habits, insufficient physical activity, and inadequate sleep (Jakicic et al., 2016; Skalamera & Hammer, 2016). Price et al. (2016) stated 31% of female college students are overweight or obese. However, this population participates less in physical activity than their male counterparts (Gu et al., 2015). Young college females can benefit from the recommended physical activity for significantly decreasing future health issues (Kvintová, & Sigmund, 2016). WFT has made fitness monitoring easier for young college females as it is an innovative and trendy way to collect and share data related to their daily activities. Young college females possess an obvious behavior of being constantly connected to electronic data for instant gratification and social interaction (Chen et al., 2016; Vorderer et al., 2016). As millennials, young college females can adopt to WFT as they are used to multitasking using smart devices (Cheon et al., 2016).

This study of young college females related to the intent for behavior change with the use of WFT was significant for understanding their lived experiences of self-monitoring and for gaining insight into how tracking daily activities motivates and encourages this millennial generation to better manage their health. The use of WFT was an influential tool for the participants of this study as instant feedback of data collected from daily activities including steps, weightlifting, nutrition, heart rate, and sleep created self-awareness and self-efficacy to improve their health.

With WFT getting smarter and more sophisticated, these devices will become even more popular. Sethumadhavan (2018) stated WFT empowers users by providing them access to data about their health habits and activity levels, serving the needs of diverse groups. WFT can quantify data for individuals such as young college females related to their daily activities or primary care physicians trying to help patients self-manage their care. This study adds to the current literature on young college females related to their health behaviors with the use of WFT. Further research is needed to investigate the potential WFT has on increasing healthy behaviors of young college females to reduce their current health issues and help prevent future issues related to this millennial and technologically focused generation.

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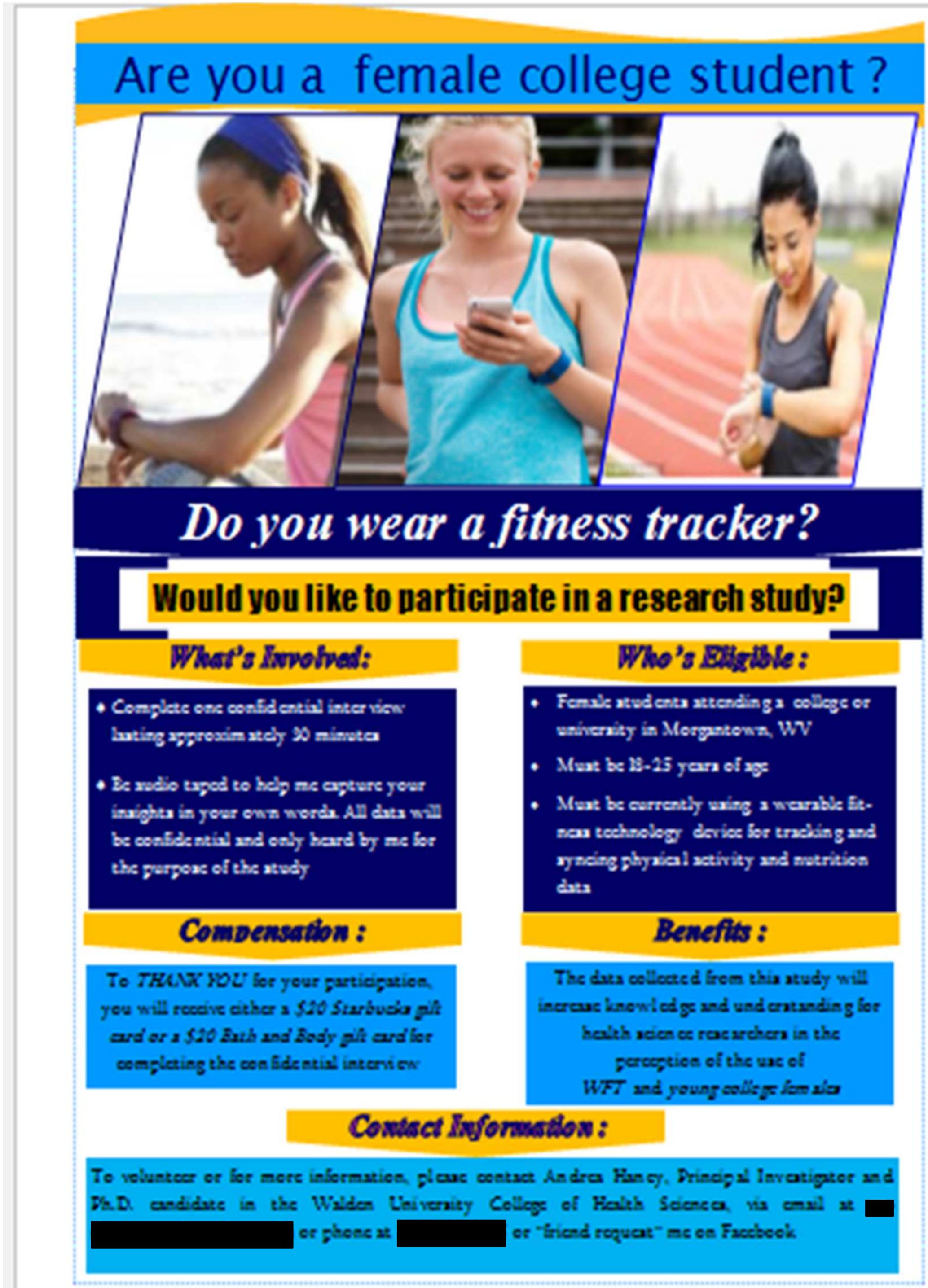
Appendix A: Recruitment Flyer



# Appendix B: Interview Protocol and Questions

Hello and welcome. Thank you for agreeing to participate in my study. My name is Andrea Haney and I am a student at Walden University. Your responses today will provide me with an understanding of the experiences young college females have with the use of wearable fitness technology. The interview will last approximately 45 minutes. Today, I will be audio-recording your responses. I will also be taking notes. Feel free to ask any questions at any time during this interview. Do you have any questions before we start? If not, then let's get started.

## Interview Questions

### Demographic Questions

1. Please tell me your name and how old you are.
2. Please tell me what college you attend, what year you are in your chosen degree or career path and if you live on or off campus.
3. Please tell me where you are previously from if West Virginia is not you home state.
4. Please tell me how long you have been using the WFT.
5. Describe your choice of WFT and the criteria for choosing that brand.
6. Please tell me about your current physical fitness activity and any goals related to physical fitness activity.
7. Please tell me about your daily nutritional behavior and any goals related to your nutritional habits.

### Perceived Susceptibility

8. Please describe your experiences of health issues in young college females.
9. Please describe any personal or family history related to health issues that may have encouraged you to choose the use of WFT.
10. Please describe any influences on how you perceive your health or health issues with the use of WFT related to health prevention.
11. Please describe your experiences of the use of WFT by young college females related to health education.

Perceived Benefits/Barriers

12. Please tell me about any specific or personal health benefits of your use of WFT.
13. Please describe your experiences of any individual physical or mental change that have occurred since using the WFT.
14. Please describe your experiences with tracking, syncing, and sharing data from WFT related to health benefits for young college females.
15. What do you perceive as barriers being a young college student towards reaching your physical activity or nutritional goals with the use of WFT.

Self-Efficacy

16. Please describe any experiences of feeling confident in the ability to reach your physical activity and nutritional goals and the use of WFT.
17. Please describe your experiences with motivation and adherence to physical activity and healthy eating habits and the use of WFT.

Aspects of WFT

18. Please tell me some reasons why you continue to use WFT.
19. Please describe your experiences with the WFT message alerts related to physical activity and physical activity goals and describe the influence this feedback has on your health behavior.
20. Please tell me about your experiences with the WFT interactive capabilities of competing with other users through social networking. If you are not using the interactive capabilities of the WFT, please tell me why you choose not to interact with other users.
21. Please describe the technological aspects of WFT you perceive necessary for changing the health behavior of young college female Millennials.
22. Please tell me about an experience that sticks out in your mind about the use of the WFT when you first started wearing the tracking band. What about now that you have worn the WFT for at least 6 months?
23. What else would you like to share about your experience with WFT?