

# BABY BOOMER ADOPTION OF HEALTHCARE APPS

by

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In 2015, approximately 500 million smart phone users were estimated to use some type of health-related app. These apps are developed intending to promote health and wellness behavior in users. However, the simple availability of a technology such as an app does not imply that it will be used effectively for its intended purpose. An app with countless benefits may go unused if it does not appeal to the user. This research applies the factors of perceived ease of use and perceived usefulness as a theoretical foundation to understand how these factors and other elements affected the adoption of healthcare apps for smartphone devices among the Baby Boomer population of eastern North Carolina. The Baby Boomer population is the second largest age demographic in the United States; second only to the Millennials. Aging Baby Boomers are at an increased risk of developing chronic diseases that will lead to increasing costs for consumers, healthcare providers, and the government. Healthcare apps are new technologies that are developed to increase patient-centered care, thus decreasing costs and increasing quality of health. Healthcare apps have the possibility of being a great resource to the aging Baby Boomer population. However, there are limited studies investigating this population and their adoption of new technologies such as healthcare apps. Participants born between 1946 and 1964 in eastern North Carolina, chosen by snowball sampling, downloaded the healthcare app, CareZone onto their smartphone devices and used it for two weeks. After the two weeks, the participants were interviewed about their experience using smartphones, apps, and healthcare apps in particular.



BABY BOOMER ADOPTION OF HEALTHCARE APPS

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by

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## DEDICATION

This work is dedicated to my grandparents, John and Virginia Patrick. You will never know how much your love has driven, guided, and protected me. I would be nothing without you both.

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Alfred N. Whitehead stated, “The worship of God is not a rule of safety-It is an adventure of the spirit, a flight after the Unattainable.” This adventure has been simply one of Faith in God and Christ.

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## **Chapter One: Introduction**

Smartphones are mobile telephones that have some of the functionality of a computer, allowing the user to run software applications and connect to the Internet (Luxton et al., 2011). Current data report that more than 58% Americans have a smartphone (Gray, 2014). One of the key characteristics of a smartphone is the applications, or “apps” that are available to users (d’Heureuse, Huici, & Arumaithurai, 2012). An “app” is an encapsulated piece of software that allow users to execute numerous functions such as listen to music, watch movies, play games, track activity, and calculate caloric intake, for example (Bredicam & Vigar-Ellis, 2014). A report by Nielsen indicated that 89% of mobile usage is dedicated to mobile apps. Today, there are over a million mobile applications provided by Google Play and the iTunes App Store (Perez, 2014). There are numerous categories of smartphone apps available to users. One area of interest that is popular with smartphone users is healthcare (Kern, 2014). Today, approximately 500 million smartphone users have downloaded some type of health-related app (Massachusetts Institute of Technology, 2014). Smartphones and healthcare apps are on the verge of becoming a pivotal part of maintaining health, decreasing healthcare costs, and redefining current healthcare models (Mohr, Cheung, Schueeler, Brown, & Duan, 2013). There are several factors contributing to this increased interest in technologies such as healthcare apps. In 2013, the United States spent \$2.7 trillion on healthcare, which comprised approximately a fifth of the country’s gross domestic product (Freedman, 2014). Another factor is the Affordable Care Act, which has shifted the current business model of healthcare from one in which more treatments equated to more money, to one focused on prevention. The Affordable Care Act does not fund treatments; instead, it funds the plan and innovations to keep patients healthy to avoid costly treatments

(Freedman, 2014). This Act has healthcare organizations examining and redefining their current business models. Many of these organizations are focusing on mobile and digital technologies as a part of the solution to cut costs and improve the health of the population. Mobile and digital technology applications include those that aid in chronic pain management, provide independence to the geriatric population, ensure safe medication adherence, and improve the healthcare system, to name a few (West, 2012).

Other countries have already implemented technology into their healthcare models with favorable results. In Europe, health-centric technologies such as mobile health technology has decreased the cost of chronic medical treatment by at least 35% within the general population (Freedman, 2014). In Britain, the National Health Service is in the process of creating an “app store” endorsing applications and technologies to aid with smoking cessation, weight loss, exercise, and more (Donnelly, 2014). A report by the Brookings Institute cited that one of the reasons America spends more money per patient than any other country is due to the low use of health-related technology (West, 2010). In the United States, researchers and entrepreneurs are seeking ways in which technology can improve health and decrease costs. For example, medication non-compliance occurs when individuals either take too little, too much, the incorrect medication, or skip it entirely. The effects of medication noncompliance and medication-related errors cost the healthcare system almost \$300 billion dollars a year (Freedman, 2014). One company, MediSafe, developed an online service and a mobile app to aid patients with tracking the timing and dosage of their medications. AirStrip Technologies, a company based in San Antonio, Texas, is on the forefront of remote patient monitoring, providing clinicians with real-time data on their smartphones or tablet, which enables them to be aware of changes that could signify a crisis and prevent a costly hospital readmission. The estimated cost this technology

could save hospitals, insurance companies, and patients would be about \$23.5 billion (Freedman, 2014).

Mobile apps, online services, remote monitoring, and other similar technologies can provide numerous benefits and advantages to healthcare (Amirkhani, Salehahmadi, Kheiri, & Hajialiasgari, 2011). In this culture of patient-centered care, emerging technologies and digital devices allow patients more control of their health, increase healthcare accessibility to underserved populations, and encourage positive behavioral changes (Moore, 2012). The culture of the all-knowing doctor and the passive patient is transitioning to one in which the physician and patient partner together, resulting in better patient outcomes (Abram, 2015). Apps that store a patient's health record can easily be sent to a new or consulting physician, thus saving time and reducing reporting errors (Ghose, 2014). Smartphone apps that connect to wireless sensors can monitor blood-oxygen levels, glucose levels and blood pressure. Other smartphone apps are in development that can perform diagnostic tests of one's breath, urine, blood, and liver. Diagnostic and health monitoring apps could decrease the cost associated with going to a clinic or a lab (Topol, 2015). In addition, many of these apps can forward the results to a hospital or physician, alerting them of any critical results.

Smartphones and healthcare apps can provide a wide array of features to aid users. However, the adoption of innovative technology such as healthcare apps is not automatic. A failure of user adoption has long been a detriment to the success of new technology (Davis, 1993). For users to reap the benefits of smartphone apps, it is important to know if the user wants to use the technology (Mohr et al., 2013). Technology developers cited "changing people's mindsets" as the biggest challenge to technology adoption (Rutherford, 2010). Initiating

and maintaining a health-related behavior change could be a challenge, regardless of the benefit of the app.

Technology enterprises, software developers, and researchers are continuously studying the factors that affect a user's adoption of a technology. As apps increase in popularity, so does an interest in studying their adoption rates among users (Dogruel, Joeckel, & Bowman, 2015). Some research focuses on smartphone app development for specific fields such as education, retail, and healthcare (Bredican & Vigar-Ellis, 2014). Others focus on smartphone app usage, app privacy, and the purpose of the app (Dogruel, Joeckel, & Bowman, 2015). Cowen (2013), Rosser and Eccleston (2011), and Visser (2014) are a few studies that focused on the potential of a smartphone app to be used and adopted. Dogruel, Joeckel, and Bowman (2015) studied the heuristic decision processes of app selection. Another area studied is the characteristics of a specific user population's adoption of smartphone apps (Pandey, Hasan, Dubey, & Sarangi, 2012). One key to the success of a new technology, such as a smartphone app, greatly depends on identifying the needs and habits of the primary "stakeholders" or the population that will be using the technology (Rutherford, 2010). Healthcare apps provide numerous benefits; however, it is important to identify the specific needs and user habits of the "stakeholders" that will use and ultimately benefit from the app.

There are numerous factors that are unique to a population and affect their technology use and adoption. These include gender, social-economic status, education, profession, and age. One population with defined boundaries, characteristics, and needs are those pertaining to a specific generation. There are five major generation demographics in the United States: the Greatest generation (born before 1928), the Silent Generation (1928-1945), the Baby Boomers (1946-1964), Generation Xers (1965-1980), and Millennials (1981-1997) (Fry, 2015). Each generation

has specific demographic, attitudinal, and cultural characteristics that affect how and why they use a specific technology. For example, more Millennials (95%) own a cell phone compared to 85% Baby Boomers, but there are more Baby Boomers (65%) than Millennials (57%) that own a desktop computer (Zickuhr, 2011). This difference is even noted in how the generations view technology and healthcare. For example, 27% of Millennials, 25% of Gen Xers, 24% of Baby Boomers, and 12% of the Silent Generation would discuss treatment options of a sensitive nature through the use of “virtual visit” (Shannon-Missal, 2014). However, 57% of the Silent generation, 52% of Baby Boomers, and 44% of Gen Xers were in favor of using virtual prescription services compared to only 42% of Millennials. Also, 34% of the Silent generation and Baby Boomers were more likely to use virtual diagnostic and lab services than millennials (25%) (Shannon-Missal, 2014). Also, each generation has a different expectation of what they expect from technology. The Silent Generation expects direction, the Baby Boomers want to be engaged, Generation X want to be educated, and the Millennials want to connect (Howe, 2009). Of these generations, the Baby Boomers are coming to the forefront with regard to the opportunities that technology can provide.

Who are the Baby Boomers? According to the US Census Bureau, a “Baby Boomer” is any individual born in the United States between the years 1946 and the middle of 1964. The Baby Boomer generation is marked by a significant rise in birth rate at the end of World War II and a steady decline after the introduction of the birth control pill (Taylor, 2014). The Baby Boomer generation is the second largest age demographic in the United States. Today, there are approximately 75 million Baby Boomers in the United States (Barr, 2014). As Baby Boomers age, they present a challenge and opportunity for healthcare. Baby Boomers’ healthcare needs involve caring for aging parents, focusing on their personal wellness, and fighting the aging



process (Howe, 2009). An article in the March 2013 issue of JAMA Internal Medicine states that while Baby Boomers will live longer, they are at a higher risk of developing chronic diseases such as hypertension, diabetes, high cholesterol and obesity (Barr, 2014). Also, Baby Boomers are hospitalized three times as often and visit a physician twice as often compared to the general population (West, 2012). This could lead to an increase in rising health costs. By 2030, there will be about 69 million Americans aged 65 and older. As a large number of Baby Boomers turn 65, they also become eligible for Medicare. Medicare is the federal health insurance program for individuals 65 years old and older (Medicare, 2015). In 2011, Medicare spent \$549 billion on healthcare (Medicare, 2015). As Baby Boomers retire and become eligible for Medicare, the cost associated with Medicare will concurrently increase.

Smartphones and smartphone apps are predicted to become a major factor in maintaining health, decreasing healthcare costs, and redefining healthcare (Mohr et al., 2013). Therefore, smartphone apps are an opportunity for Baby Boomers, with their healthcare challenges, to become more involved with their healthcare and decrease overall costs. In fact, most studies indicate that Baby Boomers constitute a large number of technology users. An average of 64% own a desktop or laptop computer (Zickuhr, 2011). Baby Boomers are one of the fastest growing demographics to use social media formats such as Facebook, LinkedIn and Twitter. Approximately 84-86% of Baby Boomers own a cell phone (Zickuhr, 2011). Though a large number of Baby Boomers own a cell phone, the activities for which the cell phone is used can vary greatly (Zickuhr, 2011). Computer usage and online technology is in high use among Baby Boomers and young adults (Russell, 1998). Baby Boomers actually comprise 53% of adult Internet users. They are also interested in using technology for their health. Reisenwitz and Iyer (2007) studied the technology habits of younger Baby Boomers - those born between 1956 and

1965 - and older Baby Boomers - those born between 1947 and 1955. In their study, 33.5% of younger boomers used the Internet to research health and medical information. More than 45% of older Boomers access the Internet for health and medical information.

Though there is research on Baby Boomers and their technology use, there are limited studies on the factors that drive and direct their use of technology. The proper use of a technology, such as a smartphone app, can bring about numerous advantages to the individuals that use them (Amirkhani et al., 2011). Luckily, boomers have shown to be willing to incorporate healthcare apps into their life (Barr, 2014). In a survey of 600 Baby Boomers, 60% of the respondents would use an app if their physician recommended it. The study further noted that 48% would download an app to monitor a chronic condition and 47% would download an app to monitor their eating and activity (Dolan, 2012).

Though there is emerging research of the potential of smartphone apps in a wide variety of clinical and healthcare settings, there is limited research about Baby Boomers and the factors affecting and influencing their adoption of smartphone apps (Pandey et al., 2012). Research pertaining to technology adoption has been a focus of the information technology community for decades (Venkatesh, 2000). There are numerous factors that have been studied with regard to technology adoption: rewards, feedback, sense of agency, and perceived usefulness (Mohr et al., 2013). Many researchers have proposed theories to better understand and predict the use of a new technology. The theory of reasoned action (TRA) was developed by Martin Fishbein and Icek Ajzen and focused on user attitude and behavior (Amirkhani et al., 2011). The diffusion of innovations theory was developed to explain why and how, and the rate that new technologies spread through different cultures (Amirkhani et al., 2011). However, the Technology Acceptance Model (TAM) proposed by Fred Davis in his doctoral study has become a

foundation model of predicting technology use. Davis asked the question, “What causes people to accept or reject information technology?” (Davis, 1989). From the many proposed and studied variables at the time of his research, Davis proposed that two determinants were most influential: perceived usefulness and perceived ease of use (Davis, 1989). Davis’s model has led to numerous other technology model developments; The Carolina Model, the Feng Chenn Tang Model, and the Meng Chan Chenn Model are just a few theories that have sprung from the TAM model. An understanding of the significance of the perceived usefulness and ease of use of a technology is necessary for the development of a high quality technology (Wallace & Sheetz, 2014).

Though much research has focused upon general technology adoption, there is a lack of research pertaining to the factors that affect the Baby Boomer population’s adoption of smartphone apps for their health. Baby Boomers are the second largest generational demographic within the United States. As Baby Boomers age, they are predicted to present challenges to the healthcare industry; however, technology developments such as smartphone healthcare apps contain the possibility of turning these challenges into opportunities. However, research reveals that user adoption of technology is not automatic. Researchers have studied several factors that can increase a user’s adoption of technology. In this study, the factors of perceived ease of use and perceived usefulness provided the theoretical foundation to understand the adoption of smartphone healthcare apps within the Baby Boomer generation.

### **Purpose Statement**

More than 60% of Baby Boomers would download an app to use, especially if their physician recommended it (Dolan, 2012). However, this number does not translate into action of actual healthcare app adoption. Adoption refers to the uptake and sustained use of a technology,

in this case, smartphone app adoption among Baby Boomers (Mohr et al., 2013). This is likely because adoption stands as an ongoing challenge between willingness to access and actual ongoing use of an app by Baby Boomers. Though 60% of Baby Boomers would download an app, many Baby Boomers don't use the app after download (Dolan, 2012). Technology development and implementation is an expensive venture. Early studies of technology adoption focused on technology within the business industry. A technology developed for a business could simplify a process, improve time efficiency, and decrease cost; however, there were many occurrences of a business investing thousands of dollars into a new technology which were not being utilized by its employees (Venkatesh & Davis, 1996). Another example involves self-service technologies (SSTs). SSTs include devices such as kiosks, mobile services, ATMs, and automated check-in machines. SSTs provide many benefits; however, these technologies could not be fully utilized unless users fully adopted and used these technologies and devices (Lin & Change, 2011). Though the benefits of a technology could be numerous, if the users are unwilling to use them, the technology is limited in its benefits to the user. A thorough examination of the factors that affect the adoption of a new technology can greatly aid in developing a technology that will be utilized to the fullest. Numerous technology adoption models have been developed through the years. For this study, the prevalent factors of the Technology Acceptance Model (TAM) were the theoretical foundation to study the adoption behavior of healthcare apps for smartphone devices for the Baby Boomer population.

The purpose of this research is to study the smartphone healthcare app technology adoption behavior of Baby Boomers in eastern North Carolina. The factors of perceived ease of use and perceived usefulness were incorporated as a foundation for understanding their adoption of smartphone healthcare apps. Baby Boomers - individuals born between 1946 and 1964 - were

invited to participate in a study to download the healthcare app, CareZone, onto their smartphone device to use for two weeks. The CareZone app was used as a representative healthcare smartphone app for this study. After this two-week period, the participants met with the researcher for an interview to discuss their experience using the smartphone app. Through these interviews, the participants' responses were coded and qualitatively analyzed to understand how perceived usefulness and perceived ease of use of the app affects adoption. The TAM models how users accept and use a technology based on the factors of perceived usefulness and perceived ease of use. Davis (1989) defined perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance" and defined perceived ease of use as "the degree to which a person believes that using a particular system would be free from effort." It should be noted that Davis proposed the purpose of this model to "provide an explanation of the determinants of computing acceptance that are generally able to explain the behavior of users a wide range of computing technology" (Lala, 2014).

### **The Research Questions and the Research Strategy**

This study focuses on the following research questions:

- Q1. Do Baby Boomers who have experience using at least one healthcare app for smartphones perceive healthcare apps for smartphones to be useful to their healthcare?
- Q2. Do Baby Boomers who have experience in using at least one healthcare app for smartphones perceive healthcare apps easy to use?
- Q3. Do Baby Boomers perceive healthcare apps for smartphones as a technology that they are willing to add to their healthcare regimen, after using such an app for a period of time?

Q4. What factors do Baby Boomers who have experience in using at least one healthcare app report would increase their adoption of healthcare apps for smartphones?

To respond to the research questions and meet the research objectives, this study employed a qualitative research methodology. Qualitative research is a research method in which the researcher seeks to explore and understand individuals or groups attributed to a social or human problem (Cresswell, 2009). Stemming from subject areas such as anthropology and sociology, it aims to understand human interactions in a way that quantitative research would prove insufficient for, in that it cannot capture the experiences, behaviors, interactions and social contexts of a population (Fossey, Harvey, McDermott, & Davidson, 2002).

Interviews were the data collection method used for this study. Interviewing allows the researcher the flexibility and ability to probe the subject matter, clarify, and create new questions based on the responses of the subjects. Formal unstructured interviews were used to gather information for this study. Formal unstructured interviews created a space for the interviewee to best describe his or her experience in qualitative data collection. The objective of the interview was to create an atmosphere in which the participant feels at ease to describe their experience with the mobile health-related app.

The researcher took on the role of the interviewer. An interview protocol was developed to formulate the appropriate questions (Knox & Burkard, 2009). The researcher/interviewer's role was one of high responsibility, and pivotal to the interviewer/interviewee relationship and data collection. The interviewer learned to manage their own reactions to participants' responses, avoid "therapeutic" responses, and avoid reactions that minimize the interviewee's responses (Knox & Burkard, 2009).

The CareZone app was chosen as the healthcare app (see Appendix D) for the participants to use. CareZone is an app that monitors medications, documents the patient's symptoms, tracks medical appointments, organizes contacts, stores discharge instructions, and other information. The app also offers a shared calendar and journal to share medical information with family or other caregivers as needed. The data is encrypted and stored in several physical and virtual servers. In addition, the app is compliant with the guidelines of the Healthcare Insurance Portability and Accountability Act (HIPAA) and as per CareZone's policy, user information is never sold to third parties. The researcher contacted and received permission from CareZone to use the app for this study (see Appendix B).

Participants were chosen by snowball sampling. Snowball sampling is a non-random (non-probability) sampling method (Sedgwick, 2013). Snowball sampling is a convenient method to study populations that are hard-to-reach (Heckathorn, 2011). The researcher actively selects the most productive sample and these subjects then recommend other potential candidates (Marshall, 1996). Participants were any individuals born between the years of 1946 and 1964 that had a smartphone and agreed to use the CareZone app for two weeks. The participants downloaded the CareZone app onto their smartphone device and incorporated the app into their daily healthcare regimen for two weeks. At the end of the second week, face-to-face interviews were scheduled and conducted. Face-to-face interviews allow the interviewer to collect verbal as well as nonverbal data (Knox & Burkard, 2009).

The researcher/interviewer abided by the ethical guidelines detailed by the East Carolina University's University and Medical Center Institutional Review Board (UMCIRB). Approval was received from UMCIRB prior to the commencement of this study (see Appendix A).

## **Thesis Organization**

The thesis is organized into five chapters. The first chapter is the introduction, which provides a brief synopsis of the current healthcare condition, the Baby Boomer population, smartphone and healthcare app adoption, and the challenge of technology adoption. The introduction also includes a brief overview of the methodology. The second chapter is a more thorough literature review pertinent to the study. The third chapter describes the methodology of the study. The fourth chapter is an analysis and interpretation of data. Chapter five concludes with a discussion of the findings of the study and expands on future work.



## **Chapter Two: Review of the Literature**

The focus of the literature review is to provide a summary and evaluation of the existing research and body of knowledge pertaining to the context of the study. This is a qualitative research study to understand healthcare app adoption among the Baby Boomer generation. The review is an overview of the demographics of Baby Boomers, the current state of healthcare in the United States, the significance of smartphones and smartphone apps, and the challenge of technology adoption, and concludes with an evaluation of the technology adoption models, focusing specifically on the technology adoption model (TAM).

The literature review strategy for this study was executed primarily by a Boolean search strategy within the academic databases of East Carolina University Joyner Library via their “OneSearch” software. The Boolean search strategy included the following keywords: Baby Boomers, technology adoption, digital, digital devices, chronic disease, chronic diagnosis, mobile health, technology, smartphone, smartphone apps, mobile devices, healthcare, technology acceptance, technology acceptance model (TAM), technology acceptance theories, and qualitative research. A secondary literature review strategy employed a Google powered search using the same keywords. Further research was conducted in the “ProQuest Dissertations and Theses Global Database” to research current academic research.

Baby Boomers are one of the five age demographics in the United States. Of the five major age demographics - the Greatest Generation, the Silent Generation, Generation Xers, and Millennials - the Baby Boomers are the second largest age demographic (Fry, 2015). There are over 76 million Baby Boomers in the United States (Orlov, 2015). According to the US Census Bureau (2006), a “Baby Boomer” is any individual that was born in the United States between the years 1946 and 1964. The beginning of the Baby Boomer generation was marked by a

significant rise in birth rate at the end of World War II, and its end by a steady decline with the introduction of the birth control pill (Taylor, 2014). During this 19-year period, the American economy was booming and its middle class flourishing. A mother during this time period had an average of three children. This was one child more than the previous generation. In 1946, the first year of the baby boom, the birth rate increased by almost 20% compared to the previous year. These rates continued to increase and reached a peak of 4.3 million births by 1957 (U.S. Census, 2014). Demographic analyzers tend to separate the Baby Boomer generation into two parts: the younger boomers and the older boomers. Younger boomers were born between the years 1956 and 1964, and older boomers between 1946 and 1955. Some publications further delineate these two groups as the Vietnam group (those born between 1946-1955) and the Me group (those born between 1956-1965) (Reisenwitz & Iyer, 2007). Though there are some differences between the two groups of Baby Boomers, most research suggests little empirical evidence of any substantial difference between the groups (Reisenwitz & Iyer, 2007). This study focused on the Baby Boomer generation as one demographic.

Every day, at least 10,000 Baby Boomers turn 65 and will continue to do so until 2030 (Cohn & Taylor, 2010). The United States healthcare system refers to the aging Baby Boomer demographic as the “Gray Tsunami.” It is a term that describes the surge of individuals born between 1946 and 1964 that is aging, requiring more healthcare resources (Keehan, Sisko, Truffer, Smith, Cowan, Poisal, & Clemens, 2008). The United States is one of the many countries experiencing increasing demands on their healthcare system related to the increase of aging Baby Boomers (Eysenbach, 2014). These increasing demands in healthcare stem from many issues related to Baby Boomers such as chronic disease management, growing health issues, and increasing medical needs (Eysenbach, 2014).

Approximately 86% of Baby Boomers have at least one chronic disease and over half have at least two or three chronic diseases (Cohn & Taylor, 2010). The term “chronic disease” describes a disease that persists for a long time, typically more than three months, and cannot be prevented by vaccination or cured with medication (Martin, 2007). Examples of chronic diseases are diabetes, hypertension, and obesity. The management of chronic diseases consumes about 70% of healthcare costs and expenses in the United States (Marcy, n.d.). For example, over \$245 billion dollars was dedicated to the management and effects of diabetes (American Diabetes Association, 2013). Chronic diseases can result in a reduction in the quality of life and increase the risk of disability and lead to untimely death (Miller, Lasiter, Ellis, & Buelow, 2015). The American Hospital Association reported that more than 37 million boomers will have a chronic disease by 2030 (Orlov, 2015). Chronic disease management requires regular physician visits, prescribed medications, training for medical self-management, and changes to lifestyle habits (Eysenbach, 2014). Other health related factors that are taxing healthcare include hospital admissions and physician visits. Baby Boomers are hospitalized three times as often and visit a physician twice as often as compared to the general population (Albert, Johnson, Gasperino, & Tokatli, 2003). As a large number of Baby Boomers turn 65, they also become eligible for Medicare. Medicare is the federal health insurance program for individuals aged 65 and older (Medicare, 2015). These needs will tax the already stretched national budget.

The traditional healthcare system is not expected to be able to handle these healthcare demands and the expenses associated with them (Eyesenbach, 2014). Experts are seeking ways to increase the quality of life and concurrently decrease costs on a burdened healthcare system. Technology is being studied as a way to transform the current healthcare system, decrease costs, and improve the quality of life (Coughlin, 2006). Health-centric technologies can do this by

providing patients a means to become more involved in their care, increase prevention strategies, and allow self-management. Healthcare-centric technologies such as mobile health technology or mHealth have been initiated globally since 2011 in the form of health call centers, SMS for appointment reminders, telemedicine, and physician decision support (West, 2012). The Agency for Healthcare Research and Quality indicates that consumer health technology applications have numerous purposes such as assisting with self-management, delivering real-time data to patients and providers, facilitating web-based support groups, and storing PHI in an easy accessible format (Eysenback, 2014). This article further reported that research predicts that remote self-monitoring could save as much as \$197 billion dollars over the next twenty-five years. This could be a significant saving contribution to the healthcare budget. There are other examples of health-related technologies saving money and improving healthcare. For example, one way for patients to become more involved in their care is through the use of technologies such as remote self-monitoring. Self-monitoring has been related to decreasing out-of-pocket costs (Orlov, 2015). A study conducted by the Mayo Clinic found that only 20% of the participants who used a smartphone app to self-monitor their blood pressure were readmitted within three months compared to 60% who did not use the app (Bresnick, 2014). Another example is Health: ELT. Health: ELT is an app that has been tested on the Medicaid population in Arizona. As patient engagement and use of the healthcare app increased from 37% to 73%, associated ER visits of this sample decreased from 7.14 visits to 3.45 visits per patient per month (Orlov, 2015). This is a significant saving when a non-critical ER visit can cost \$300-\$3000 (Orlov, 2015).

The growth of health-centric technologies has been further reinforced by a recent Gallup Poll Study. The study, “How Mobile Technology Can Improve Employee’s Well-Being” reported that one in five people utilize some form of mobile technology for wellness

improvement (Kern, 2014). Some experts are predicting that we are in the decade in which mobile communication technology, such as smartphones will transform healthcare (Slabodkin, 2013).

Mobile communication technology has progressed through the years. The first mobile phone was created in 1973 by Motorola. It weighed over 2.5 pounds, measured nine inches and cost almost \$4,000 (Alfred, 2008). Approximately 20 years later, in 1992, IBM designed the first “smartphone” (Terry, 2010). Smartphones are mobile telephones that have some of the functionality of a computer that allow the user to run software applications and connect to the Internet (Luxton et al., 2011). However, it wasn't until 2001, with the Palm OS Treo, that the smartphone began to become more practical and offered features such as a full keyboard, wireless web browsing, email, and the ability to download third-party programs (Terry, 2010).

As the use of smartphones increased, so did research and development by manufacturers to develop a more efficient smartphone. This research was led by two catalysts: increased smartphone computation power and sensor availability, and the cultural acceptance and increase of smartphone usage (Lathia et al., 2013). Today more than 58% of citizens in the United States own a smartphone (Gray, 2014).

A unique feature of a smartphone are apps. An “app” refers to an encapsulated piece of software that can manually be added to a smartphone to personalize its functionality (Bredicam & Vigar-Ellis, 2014). In 2007, Steve Jobs introduced the first generation iPhone (Jacques, 2012). The introduction of the iPhone was significant because it also introduced the App Store, where iPhone users could download a variety of apps specifically for the iPhone (Terry, 2010). In approximately two years after its introduction in 2007, there were over 100,000 apps available for users of the iPhone (Terry, 2010). In addition to the iPhone, other smartphones and operating

systems (OS) are available on the mobile technology platform: Android from Google, Blackberry OS, Apple's iOS, and Windows smartphone with a Microsoft OS (DeBenedette, 2013). The majority of smartphone users in the United States spend their time using mobile apps and the average smartphone user has about 40 apps on their smartphone device (Kim, Yoon, Han, 2014; Urban & Sultan, 2015). As of 2014, there were 1.2 million apps available in the App Store and over 1.3 million apps available for the Android operating system (Urban & Sultan, 2015).

The categories of apps are numerous. Education, utility, games, reference, and social media are only a few categories that define the many types of apps (Wano & Lio, 2014). Another category of apps is those pertaining to health and medical needs. In the past few years, healthcare apps have seen a surge in development and utilization (Kabachinski, 2011). A report in 2012 reported more than 97,000 mobile health applications (Flaherty, 2014). The top ten of these applications generated over 4 million downloads per day. Approximately 80% of primary care physicians use smartphones and apps in their daily practice (Ritchi, 2013). In addition, physicians are beginning to recommend mobile health apps to their patients for managing their chronic diseases ("More physicians," 2013). Dr. Eric Topol, a cardiologist and director of the Scripps Translational Science Institute, predicts that smartphones and apps will play a pivotal part in the medical revolution (Topol, 2015). Mobile apps are significant because they are deemed part of the strategy to reduce cost in the healthcare industry (Orlov, 2015). Smartphone and healthcare apps have the potential to improve health by allowing the individual to become a more active participant in their health, decreasing costs and increasing the quality of life. Considering the current healthcare atmosphere and the need for cost efficiency in managing health conditions, the Baby Boomer generation is predicted to be the primary candidate

benefiting from healthcare technology such as healthcare apps (Eysenbach, 2014). However, what exactly is a healthcare app?

Healthcare apps are those that aid in chronic disease management, lifestyle change management, and low acuity self-diagnosing (Boulos et al., 2014). Healthcare apps offer several features to address a user's healthcare needs. The primary and defining features of healthcare apps include the ability to track vital signs, blood pressure and blood sugar, maintain personal information storage, ability to provide general information (not advice), and/or appointment and medication reminders ("Medicines and Healthcare", 2014). The most popular health apps are focused on exercise, diet, weight loss, blood pressure, diabetes, blood pressure, medications, and pregnancy (Randolph, 2013). Healthcare apps should not be confused with medical apps. Medical apps include those that target healthcare workers such as physicians, nurses, and therapists. Medical apps tend to be more complicated, use medical terminology, and cannot be easily understood by laypersons (Boulos, Brewer, Karimkhani, Buller, & Dellavalle, 2014). In addition, medical apps are defined as apps that include "copies" of references found in a textbook, track and make recommendations, and assist with medical office functions (Franko, 2013). For example, Glucose Buddy is a healthcare app that allows a layperson to track their blood glucose and diabetic medications (DeBenedette, 2013). An example of a medical app is iMurmur, which aids healthcare professionals in recognizing abnormal heart sounds (Terry, 2010).

### **Baby Boomers, Technology, and Healthcare**

Baby Boomers have a unique stance within technology use. Though they have not known technology their entire life like the Millennials, neither are they like the Silent Generation, who had minimal exposure to it. Most Baby Boomers received their exposure to

technology through the workforce (Eysenbach, 2014). Though Baby Boomers may be comfortable with using technology, they generally do not turn to it as their first choice in communicating, information seeking or support with everyday needs (Eyesenbach, 2014).

How do Baby Boomers use technology? Approximately 84-86% of Baby Boomers own a cell phone (Zickuhr, 2011). Eighty-eight percent of Baby Boomers access the Internet and they compose over 53% of total adult Internet users (Tennant, Stellefson, Dodd, Chaney, Chaney, Paige, & Alber, 2015; Zickuhr, 2011). Baby Boomers use the Internet for news, instant messaging, and making purchases (Zickuhr, 2011). Baby Boomers are also using advanced digital devices, such as smartphones, for mobile Internet access (Tennant, et al, 2015). It is predicted that as Baby Boomers begin retiring, their Internet activity will be more of an information source for leisure, social interactions, and healthcare information (Reisenwitz & Iyer, 2007).

The statistics are even more positive with regard to Baby Boomers and their health. According to the study by Reisenwitz and Iyer (2007), 33.5% of younger Boomers used the Internet to research health and medical information. More than 45% of older Boomers access the Internet for health and medical information. In a survey of 600 Baby Boomers, 60% of the respondents would download an app to use if their physician recommended it, compared to only 18% who would do the same if a family member suggested it. The study went further to note that 48% would download an app to monitor a chronic condition and 47% would download an app to monitor their eating and activity (“Mitchell Poll,” 2012). According to a survey by Mitchell Poll (2012), 48% of 600 Baby Boomer smartphone users would download an app that would monitor heart disease, diabetes, or chronic disease. However, many Baby Boomers don't use the app after download. Though Baby Boomers have access to technologies such as



healthcare apps, there is limited research on their adoption of these technologies (Eysenbach, 2014). The California Health Care Foundation published a report concerning Baby Boomers and their adoption of mobile health. Although it recognized the benefits of mobile technology, the survey revealed that market acceptance of healthcare apps is limited and buy-in from Baby Boomers has been slow (Orlov, 2015). Experts interviewed for the report cited several reasons, such as design, usability, cost, and online access for this slow rate of adoption among Baby Boomers.

Many of the new technologies for health are not designed with the needs of the Baby Boomer population in mind. For example, participants with an average age of 65 stated that an activity tracker was perplexing, the directions unclear, and the syncing not obvious (Orlov, 2015). It is doubtful that most developers consider that dexterity decreases with age and swiping or touching a screen can become difficult (Orlov, 2014). Most health-centric technology innovators and designers are focused on 30-50 year olds and do not consider the needs of Baby Boomers (Orlov, 2014).

Some experts believe that cost could be a deterrent in app adoption. Numerous research studies have been conducted regarding a person's willingness to pay for healthcare services linked to treatments and treatments that correlate to quality of life. However, cost may not be a deterrent for Baby Boomers. Baby Boomers control about 70% of the nation's disposable income and have the greatest concentration of wealth of any generation (Orlov, 2015). Furthermore, Baby Boomers are willing to pay for apps. A survey of 600 Baby Boomers who use smartphones reported that 71% would pay for a medical app and 36% would be willing to spend an average of \$1-\$2 on an app and 35% would spend as much as \$10 ("Mitchell Poll," 2012).

Another factor is that many developers do not consider the expectations of Baby Boomers. Baby Boomers have expectations of the technologies they desire to use. They desire technology that is safe, user-friendly and flexible to adapt to their individual needs. Author and futurist Michael Rogers states, “Baby Boomers see technology as a gift, not a given, so they are less likely than younger consumers to take it for granted. At the same time, Baby Boomers aren’t dazzled by every new gadget that comes along. Yet by embracing innovative new services and devices, and using them in unexpected ways to enhance their lifestyles and values, Baby Boomers are having a tremendous influence on emerging technologies” (Rogers, 2009).

### **Technology Adoption Models**

Though research of technology adoption and Baby Boomers is slowly emerging, research concerning technology adoption is not. A technology can provide numerous benefits; however, there is always concern that the technology will be underutilized (Venkatesh, 2000). A technology that is properly utilized can result in increased productivity and financial savings, while a technology that is not adopted or met with reluctance on the part of users can result in great financial loss, decreased productivity, and dissatisfied users (Venkatesh, 2000). For example, the fitness wearable FitBit has sold countless units; however, only about half of the 20 million people that purchased a FitBit are still using them (Orlov, 2015). Another example concerns CarePass, a technology platform developed by the insurer, Aetna. CarePass lasted barely a year due to poor user adoption (Orlov, 2015).

For these reasons, information technology adoption and utilization is an important area of technology research (Venkatesh & Davis, 2000; Amirkhani et al., 2011). The survival of a technology is dependent on the user’s adoption of technology. The lack of technology adoption among users can not only impend the success of a new technology, but can eradicate its very

existence. There have been numerous technology adoption models proposed and studied to better understand and predict the use of a new technology. Theories and models that explore the reasons regarding the acceptance and adoption of a new technology create an appropriate theoretical framework that can eventually be used in the development that affects the user uptake and success of a technology (Lala, 2014). Technology adoption is an important and pivotal factor because it will determine the success or failure of a technology (Davis, 1993).

Technology adoption is not simple. Researchers have been attempting to identify variables that influence the integration of new technologies since the 1970s (Legris, Ingham, & Collerette, 2003). Models of adoption are extremely complex due to many factors. Straub (2009) identified multiple components that contribute to the complexity of technology adoption. Straub's research acknowledged three aspects of technology adoption that challenged researchers: (1) technology adoption is a complex, social, and developmental process, (2) individuals develop a unique but flexible perception of technology that influence their adoption, and (3) successful technology adoption must address cognitive, emotional and contextual concerns (Straub, 2009). Other researchers have examined technology adoption from the perspective of security, social influences, trust, and risk (Lin & Lin, 2014). Some researchers believe that adoption is dependent on the characteristics, needs, and preferences of the end user, the features of the technology, and the features that relate to its social, healthcare, and regulatory policies (Schulz et al., 2013). Other experts predict that successful adoption depends on a receptive audience and an appropriate technology (Eysenbach, 2014). On another note, researchers believe that a technology should be esthetically pleasing, engaging, reliable, easy to learn, and affordable. As one can concur, technology adoption is a challenge due to the many

factors that are influential in technology acceptance. These numerous factors have led to the development of several models exploring the adoption of technology.

Everett Rogers provided one of the first models of technology acceptance and adoption in his book, *Diffusion of Innovations* published in 1983 (Spil & Schuring, 2006). The Diffusion of Innovation model considered of four parts in predicting user acceptance: innovation (new technology), communication channels, time period, and the members or users (Spil & Schuring, 2006). Rogers proposed that the decision to use a new technology (an innovation) involved a five-step process: (1) knowledge: a person becomes aware of an innovation (a technology), (2) persuasion: a favorable or unfavorable attitude is formed, (3) decision: a choice to adopt or reject is made, (4) implementation: the innovation (technology) is used, and (5) confirmation: an evaluation of the result of the decision is made (Figure 1).

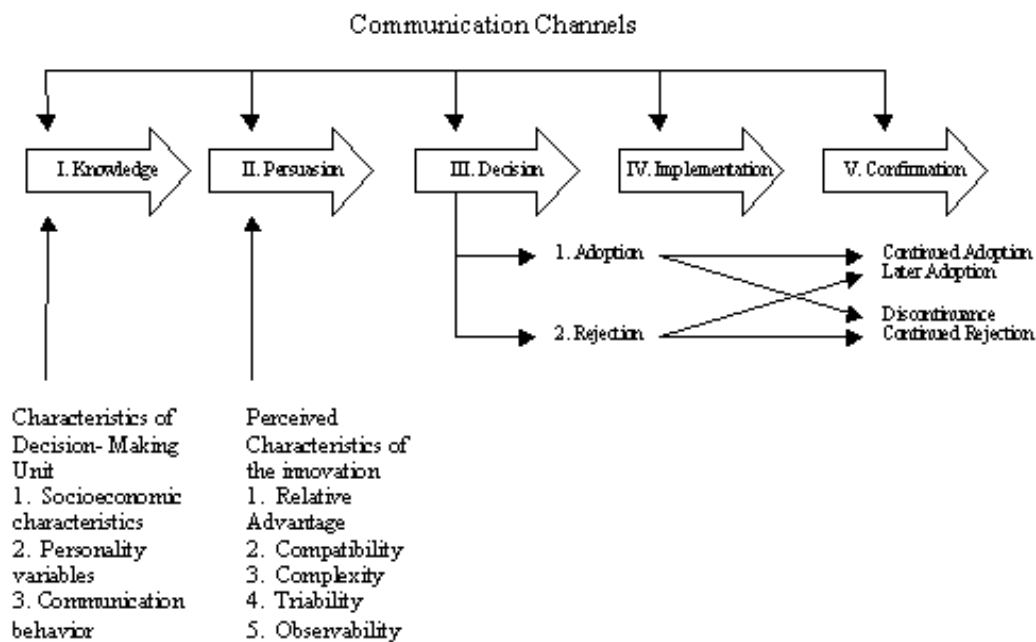
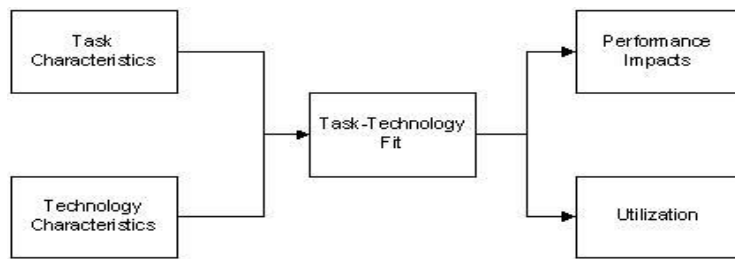


Figure 1. The Five Step process in choosing to use a new technology or innovation in Rogers Diffusion of Innovation Model. Copyright 2005 by The International Review of Research in Open and Distributed Learning.

In 1995, Goodhue and Thompson developed the Task-Technology Fit (TTF) model (Figure 2). The Task-Technology Fit model focused on the ability of a technology to support a task. A foundation of the TTF model is that, for a technology to be used, the functions available to the user must support or fit the activities of the user (Shih & Chen, 2013). TTF considers that the value of a technology is greatly affected by the tasks of the user (Goodhue & Thompson, 1995). TTF is considered to be a good tool for developing a diagnostic tool for analyzing how information systems can support various tasks in an organization (Spil & Schuring, 2006).



Source: Goodhue and Thompson, (1995)

Figure 2. The Technology Task Fit Model developed by Goodhue and Thompson (1995).

Another model is the Theory of Reasoned Action (TRA) (See Figure 3), which suggests that the reason an individual adopts a behavior toward a technology is related to the belief and expectation surrounding the adoption and the behavior of the technology (Ajzen & Fishbein, 1980). An individual’s performance is determined by their behavioral intention (BI) to perform, which is determined by their attitude and their subjective norm (SN) (Lala, 2014). TRA has been used to understand the adoption of behaviors, technology, or advice (Wallace & Sheetz, 2014).



Figure 3. Theory of Reasoned Action

The theory of reasoned action was pivotal to the development of the Technology Acceptance Model (TAM) proposed by Fred Davis in 1986 in his doctoral thesis (Legris, Ingham, & Colletette, 2003). TAM replaced the measure of attitude toward a behavior in the TRA model (Lala, 2014). Davis (1993) noted that explaining why a system is unacceptable is not enough; it is also important to understand how to improve user acceptance through the design of the system. Thus, when Davis developed TAM, his goal was “to provide an explanation of the determinants of computer acceptance that is in general, capable of explaining user behavior across a broad range of end user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified” (Davis, Bagozzi, & Warshaw, 1989). The research and work over TAM by Davis led to the focus on two factors regarding predicting and explaining user behavior. These two theoretical constructs were perceived usefulness and perceived ease of use (Davis, Bagozzi, & Warshaw, 1989).

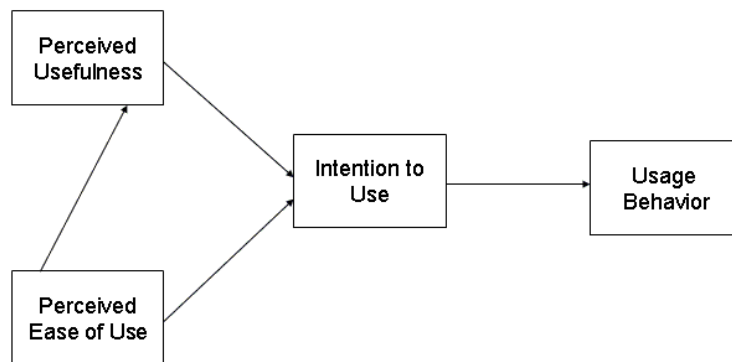


Figure 4: Perceived Usefulness and Perceived Ease of Use are two factors that influence the intention to use a technology, as described in the Technology Acceptance Model. Copyright State University of West Georgia.

Perceived usefulness is a variable of whether an individual will or will not use an application to the extent the individual believes that it will or will not aid them in performing a

task better. A system or application that is deemed to be of high perceived usefulness is one that the user perceives the existence of a positive use-performance relationship (Davis, 1989). Perceived usefulness has been shown to have a direct and indirect effect on the intention of a person's behavior to use the technology (Wong et al., 2013).

Perceived ease of use refers the degree to which a person believes that using a particular system should be free of effort (Davis, 1989). Perceived usefulness is found to have a strong influence on intention while perceived ease of use has a smaller effect that decreases over a period of time (Huang & Martin-Taylor, 2013). Together, perceived usefulness and perceived ease of use is necessary for developing and designing practical technology of a higher quality (Wallace & Sheetz, 2013).

Many researchers have used TAM to understand user technology adoption (Park & Chen, 2007). A study by Chua and Hu (2001) suggested that TAM may be a more appropriate model to study the technology adoption of an individual. Furthermore, a study by Fang (2005) focused on wireless PDA devices, wherein the two primary factors of TAM - perceived ease of use and perceived usefulness - were found to be more influential than factors such as perceived playfulness. The reliability and validity of the TAM has been tested extensively by researchers and has a success rate of about 40% in regard to a system's use (Venkatesh & Davis, 2000). An analysis of 80 articles that used TAM found that a high proportion of the articles had positive results with few inconsistencies (Gardner & Amoroso, 2004). Furthermore, studies have shown that TAM is comparable with the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB) (Venkatesh & Davis, 2000). TAM was originally developed as a predictor of a user's initial adoption of a new technology; it is also appropriate for studies "after a very brief interaction with a system" as a prototype or in a pre-adoption trial, and would be appropriate for

this study, in which the participants would only use the technology for two weeks (Hong, Thom, & Tam, 2006). As of January 2000, fourteen years after TAM's introduction in 1986, the Institute for Scientific Information's Social Science Citation Index listed 424 journals that have referenced TAM (Venkatesh & Davis, 2000). The TAM model has led to numerous technology models, the Carolina Model, the Feng Chenn Tang Model, and the Meng Chan Chenn Model being a few technology adoption models that have developed from it.

A drawback of TAM is that although it explores the "what" and "why" of users' perceptions, it does not explore the "how" by which such perceptions can be altered (Huang & Martin-Taylor, 2013). Other limitations of TAM include the type of applications that are studied and the self-reported use when examining the model. Though behavior intentions are good predictors of usage, many studies do not measure the actual system usage in their studies incorporating TAM (Gardner & Amoroso, 2004). Another concern is the result of the high reliability and validity of TAM, and the large proportion of variance in intention explored by perceived usefulness and perceived ease of use could be an artifact of the measurement approach. Davis and Venkatesh (1996) studied this concern by grouping and intermixing the items of TAM. The grouping and intermixing of the questionnaire items did not have a significant effect on reliability and validity of TAM.

### **Conclusion and Summary**

The optimal adoption of a technology can have numerous benefits. In commercial aviation, self-service technologies, such as ticketing kiosks, are pivotal in reducing operating costs and improving service (Abdullah, 2012). In the education sector, the adoption of a new technology, such as an e-portfolio system, can support a student's achievements and become a



showcase of the student's work for peers and professors (Schroff, Deneen, & Ng, 2011).

However, low user adoption can be a costly endeavor with regard to money, time, and resources.

Researchers believe that for Baby Boomers to benefit from smartphone apps, developers and designers must include Baby Boomers in the process of development (Orlov, 2015). However, there are limited studies investigating the adoption of smartphones and fewer still that study individual perceptions that can explain smartphone and healthcare (Park & Chen, 2007). Although research is emerging concerning smartphone apps, there is insufficient research concerning Baby Boomers and the factors that affect their adoption of smartphone apps (Pandey et al., 2012). In fact, general research pertaining to technology adoption and Baby Boomers is limited (Eysenbach, 2014).

Numerous experts in the healthcare industry are lauding technology as the multi-faceted solution to decrease healthcare cost and increase quality of life, specifically in the aging Baby Boomer generation. However, the history of technology adoption research and development has proven that technology acceptance and adoption is not automatic, nor is it without effort and planning. Though technology adoption has been an area of study in information technology for years, there is limited research regarding smartphone, smartphone apps, and their adoption by the Baby Boomer generation. Of the numerous technology adoption models available, TAM was used to explore the factors that influence a Baby Boomer's adoption of smartphone apps for healthcare. TAM was deemed most appropriate for several reasons. It is an ideal model for studies where the individuals of the population have control over whether or not they choose to use the system (Schroff, Deneen, & Ng, 2011). The participants of this study were at liberty to use the system as they chose. Also, TAM is ideal for studies in which the participants have a brief interaction with technology. For this study, the app was used for two weeks (Hong, Thom,

& Tam, 2006). Though many factors influence the acceptance and adoption of a technology, the factors of perceived ease of use and perceived usefulness have shown to play a greater role in predicting adoption (Hu, Chau, Sheng, & Tam, 1999).

The underlying theme of TAM is that if a technology is able to enhance performance and does not increase the effort, it will be considered useful and easy to use, and the person will be more likely to adopt the technology (Wallace & Sheetz, 2014). TAM has received empirical support for its robustness and is parsimonious in its ability to predict technology acceptance and adoption by focusing on an individual's behavioral intent to perform a certain task (Wong, Osman, Ghoo, & Rahmat, 2013). In addition, TAM has been closely identified with other models. Dishaw and Strong (1999) proposed that TAM and TTF, if integrated, could provide a stronger model because both were developed to understand users' choices of IT. In this study, extending both the constructs of TAM and TTF provided a better explanation for variances in the utilization of IT than the two models separately.

As the Baby Boomer generation matures, the market for various technologies to aid in monitoring their health, assist in transitioning to an active retirement, and enabling them to live independent lives is growing (Naziri, 2015). Technology adoption is also an additional challenge to this situation. However, instead of technology adoption being an obstacle, the theories and models that have been developed should be embraced to provide technologies that empower Baby Boomers and their health. Embracing the challenges described in this study as opportunities, the healthcare sector, the technology industry and Baby Boomers have endless rewards to gain.

## **Chapter Three: Research Methodology**

The purpose of this research is to study the smartphone healthcare app technology adoption behavior of Baby Boomers in eastern North Carolina. The factors of perceived ease of use and perceived usefulness, based on the TAM model, were incorporated as a foundation for understanding their adoption of smartphone healthcare apps.

This chapter describes the research design and framework for conducting the study to meet the objectives. A thorough explanation of the research method is provided. In addition, a detailed explanation of the data collection method is presented. This chapter will conclude with a summary of the assumptions, limitations, delimitations, and ethical assurances of the study.

### **Research Method and Design**

Qualitative research is a process in which the researcher immerses oneself into the situation in search of meaning (Tracy, 2013). This method is valuable for answering the “why” and “how” questions regarding human behaviors and, in turn, can be used to generate a hypothesis or create a theory (Mistry, 2012). In this study, the “how” and “why” referred to the technology adoption behavior of Baby Boomers and healthcare apps for smartphone devices.

This study employed a qualitative research methodology for several reasons. Chief among them is the fact that qualitative methodology generates data that would be missed in structured surveys or experiments (Tracy, 2013). One of the advantages of qualitative research is the possibility to uncover salient issues that can then be examined in more structured, quantitative studies. It allows a researcher to study the context of interest, but where there may be a lack of reason for studying. In fact, the process of coding, sorting and sifting of qualitative data can, in fact, be extended to populations with similar characteristics, thus providing a rich and complex understanding of a specific social context or phenomenon that can be generalized

over a population (Chowdhury, 2014). Qualitative research is also understandably best appropriated for knowing what a population is actually doing. Lastly, qualitative research opens us to understanding the world and society, providing knowledge that targets issues, questions, and problems (Tracy, 2003).

Though qualitative research stemmed from anthropology and sociology, it has gained acceptance in the technology field. Initially, qualitative research within the field of information systems and information technology was challenged. Over 30 years ago, an average of 85% of research regarding information technology used quantitative methodology (Myers & Avison, 2002). This began to change in the late 1990s, as qualitative research began to be consistently published in major American technology journals (Trauth, 2001). However, through the years, qualitative methodology has grown and provided a rich portfolio of knowledge to the discipline (Conboy, Fitzgerald, & Mathiassen, 2012). This increase in qualitative research stems from the fact that technology is becoming recognized as a broad discipline that has direct relationships with people and behaviors (Myers & Avison, 2002).

A disadvantage of qualitative research is that the results cannot be generalized to a particular population because the goal is to develop a deeper understanding of a particular phenomenon rather than finding a causal link between a specific set of factors (Mistry, 2013; Chowdhury, 2014). Though the qualitative findings cannot be tested for statistical significance, the conclusions can be developed from noting patterns and themes and taken a step further by comparing and contrasting data to sharpen an understanding of the results. Another challenge of data analysis concerns the condition of presence as criteria for quality in that it is assumed that the data collected is of high quality and independent of interpretation of the collector (St. Pierre & Jackson, 2014). This, in turn, leads to difficulty in determining how representative the sample

is and how authentic the results are (Chowdhury, 2014). Qualitative data analysis is also considered to be biased by the researcher's opinions and perceptions, thus leading to casual and nonsystemic results (Chowdhury, 2014). These challenges are addressed in the delimitations and limitations section.

## **Sample**

In qualitative studies, the samples are small and purposeful, versus large and random as in quantitative study designs (Mistry, 2012). In qualitative research, the sampling is a balance of available resources with a sufficient number of cases that are information-laden (Mistry, 2012). Qualitative research typically follows the foundation of theoretical saturation which occurs when the researcher finds nothing new from the collected data (Chowdhury, 2014). Baby Boomers were the population that were selected as the subject of this study. Baby Boomers included those individuals born between 1946 and 1964. Ten participants from eastern North Carolina were recruited and interviewed for this study. The participants ranged in age from 53 to 69. 7 were male and 3 were female. Each participant was assigned a code to provide confidentiality.

Snowball sampling, a type of non-random (non-probability) sampling methodology was used for this study. Snowball sampling was the most suitable method for studying a population, such as Baby Boomers, that were not readily available to the researcher (Heckathorn, 2011). The researcher made contact with several individuals through describing the age criteria of the population and what the study required from the participants. The requirements of the study were to be a resident of eastern North Carolina, born between 1946 and 1964, an owner of a smartphone, willing to download the CareZone app onto their smartphone, use the app for two weeks, and be interviewed about their smartphone app usage and experience, in addition to their experience with the CareZone app. Individuals who met these requirements were encouraged to

invite other qualified participants to participate in the study by contacting the researcher. Participants that agreed to be a part of the study were contacted through a call, text message, face-to-face meeting, or email to further discuss the purpose of the study. Two weeks after downloading the CareZone app, the participants were contacted to schedule the interview date, time, and location based on participants' availability.

The CareZone app was chosen as the healthcare app (see Appendix D) for the participants to use. Healthcare apps for the general public are those that aid in chronic disease management, lifestyle change management, and low acuity self-diagnosis (Boulos et al., 2014). In addition, features of these types of apps include the ability to store vital signs, blood pressures, and blood sugars, the ability to collect patient information, provide general information (not advice), and/or appointment or medication reminders (“Medicine and Healthcare,” 2014).

Some healthcare apps focus on one aspect of health. Apps such as Weight & BMI Diary and MediSafe focus only on monitoring weight and reminding an individual to take medication, respectively (Aitken, 2013). Yet, other apps such as Glucose Buddy and iTriage focus on tracking blood glucose and providing health-related information, respectively (DeBenedette, 2013). The CareZone app was chosen because it provides many of the features that define a healthcare app: it provides storage of medical records, medication reminders, health data trackers, and health information (Hardy, 2012). In addition, it offers a journal to note patient conditions and appointment reminders. Due to these features, CareZone was deemed a valid representation of the objectives of a healthcare app.

There is an increasing need for Baby Boomers to be educated on digital security issues such as identity theft, financial fraud and loss of personal data (“AVG Technologies”, 2012). The CareZone app was also chosen to ensure the safety of the participants, because of the

importance it placed on securing its users' information. The data is encrypted and stored in several physical and virtual servers. CareZone has an overt policy of "no ads, no data mining" (Hardy, 2012). In addition, the app is compliant with the guidelines of the Healthcare Insurance Portability and Accountability Act (HIPPA), and as per CareZone's policy, user information is never sold to third parties. The researcher contacted and received permission from CareZone to utilize the app for this study (see Appendix B).

The participants were asked to use the CareZone app for a time period of two weeks. This was done so that the participant would have direct experience with the app for an adequate amount of time to collect insightful feedback. Though some research studies are based on the user's perception of the technology, empirical evidence suggests that direct experience is better for studying and predicting technology adoption than indirect experience (Karahanna, Straub, & Chervany, 1999). Direct experience allows the user to gather more information, to evaluate with confidence and clarity, and provide more authentic feedback (Karahanna, Straub, & Chervany, 1999). Also, it is important to note in technology research that the task assigned for the participants are representative of typical user activities and the participants are able to adequately focus on the activity (Kuniavsky, 2016). The participants of this study were allowed to use the CareZone app without strict requirements. The researcher wanted the healthcare app activity to be typical of the participants' typical smartphone app usage.

In consideration of the timeframe to use the app, there are a range of timeframes to consider for collecting information of a user's app experience. Devanuj and Joshi (2013) noted that technology adoption occurs within different timeframes and differs for each individual. In testing the user experience of a healthcare app, some researchers conduct a simple evaluation after a few minutes of navigating the app and other researchers allow a timeframe of one day as

sufficient amount of time to evaluate the major pros and cons of the app (Boudreaux, Waring, Hayes, Sadasivam, Mullen, & Pagoto, 2014). In the realm of app development and user testing, after an app has been fully developed, a time period of a couple of weeks or a couple of months is adequate, however a shorter period of time is preferable (McCann, 2011; Morel, Alves, & Cadet, 2011). For this study, the participants had direct experience with the CareZone app for two weeks to provide the participants enough time to gather information, confidently evaluate, and provide a authentic feedback.

### **Interview**

The method for data collection for qualitative studies differs from quantitative studies because of the nature of the research questions. Although there are several types of specialized techniques, the primary methods of qualitative research are direct observation, in-depth interviews, and focus groups (Mistry, 2012). This study used formal unstructured in-depth interviews. Formal unstructured in-depth interviews are described as “a conversation with a purpose” (Mistry, 2012). The interview method has become the predominant method of data collection. The interview is meant to capture the authentic voices of the interviewee, who should be treated with the upmost respect (St. Pierre & Jackson, 2014). An interview guide (Appendix E) was developed and used during each interview. The interview composed of 11 questions divided into three sections. The first section consisted of 2 questions inviting the participant to share their experience with smartphones and smartphone apps in general. The second section included 6 questions that discussed their experience with the CareZone app. The third part of the interview featured three questions that discussed their opinions and recommendations for future healthcare app usage and development.



The number of subjects interviewed was dependent on the purpose of the study. It is possible that the number of subjects may be too small or too large in some cases. If too few individuals were interviewed, it would not be possible to answer the research questions or discover themes. Too many interviews would lead to an inability to make strong interpretations of the data. For a qualitative study, interviews are conducted until a point of saturation is met (Kvale, 1996). Saturation is achieved when the data no longer contributes to the study and becomes predictable and repetitive (Tracy, 2013). In qualitative research, honing in on specific cases provides the advantage of detailed investigation of a specific behavior and a clearer understanding of the individual and the situation (Kvale, 1996). In this study, the number of interviews focused on Baby Boomers (the individual) and their interaction with the CareZone app (specific behavior). Per Thomas and Pollio (2002) state that the most appropriate number of participants for a qualitative research study may range from 6- 12 participants. Tracy (2013) suggests five to eight interviews as an appropriate number of interviews. However, it is not uncommon for the sample size to be adjusted as the study progresses. If redundancy is noted after six interviews, then the research may decide to stop at six participants. Furthermore, with regard to qualitative research, a single study can provide detailed information of the relationship between the individual and the situation being studied (Kvale, 1996). For this study, no new information was collected after the tenth interview and saturation was noted.

### **Data Collection**

The interview was conducted as detailed:

1. The researcher re-explained the study and answered any questions or concerns.

Confidentiality was assured throughout the study. Each participant was assigned a code in the following form: "InterviewX\_XXXX\_XXXX". For example, the first

- participant's interview was scheduled for December 1, 2015 for 2:30pm. This would be coded as Interview1\_1201\_1430; “1201” represents the month and day of the interview and 1430 is the military translation of the time of the scheduled interview.
2. The consent form (Appendix C), provided by East Carolina University and approved by the IRB committee, was presented and explained to the participant. The consent explained the purpose of the study, risks, and contacts for any questions or concerns. After reviewing the consent form, the participants signed it.
  3. The interview guide included a demographic survey that consisted of 10 questions. After consent was obtained, the participants were asked to complete the survey (Appendix F).
  4. The interviews were recorded to allow for a complete and full examination of the results. An Olympus Digital Voice Recorder was used to record the interviews. Participants were encouraged to answer freely, but were informed that they did not have to answer any question they were not comfortable answering and could stop the interview at any time.
  5. The researcher took notes and made observations on the interview guide during the interview.
  6. After the completion of the interview, the tape recorder was turned off. A debriefing was conducted and any questions answered. The debriefing was important because it allowed the participant to “think aloud” about the interview. Also, this process was important to help the individual “reground” after the interview (Olsen, 2011).
  7. After the completion of the interview, the participant was presented with a \$10.00 gift card.

8. The audio files were transcribed through the online transcription provider Rev. com.
9. The transcriptions were reviewed by the researcher for accuracy.

Each participant received a copy of the interview transcript for an additional level of member checking and data verification. The participant was instructed to provide any corrections or comments.

### **Data Analysis**

The interviews produced audio recordings that were transcribed into written text. Accuracy was validated by a comparison between the audio recording and transcription by the researcher and verification of member checking by each participant reviewing and approving the text. The researcher took notes during the interviews and these observations became part of the data collection.

The data collected was analyzed with the assistance of NVivo 10© computer software (Appendix G). NVivo 10 is a CAQDAS (Computer Assisted Qualitative Data Assistance Software) program for organizing and assisting in the analysis of qualitative data. Benefits of using qualitative software such as NVivo are numerous compared to the manual (pen and paper) method. The software also facilitates more efficient data collection and analysis. It allows multiple positions to be highlighted to provide the ability to conduct a micro-analysis. Another feature is the ability to quickly retrieve sections of data (Ryan, 2009). Researchers are able to understand and interpret the experiences to a greater extent with the assistance of the digital logic of software (Chowdhury, 2014). However, qualitative software is not a means to analyze the data, but to organize and link data (Ryan, 2009). CAQDAS such as NVivo are only able to assist in organizing the data; the actual analysis is done by the researcher.

The basic analysis of qualitative data is to search for patterns in the data and ideas that

will aid in explaining why those patterns exist (Saldana, 2013). A grounded theory method (GTM) analysis was used to analyze the data. Grounded theory was developed by Glaser and Strauss in 1967 and was further studied in 1990 and 1998 by Strauss and Corbin, and finally in 2006 by Charmaz (Tracy, 2013). Grounded theory describes a systematic inductive analysis of data from the “ground” up (Tracy, 2013). Instead of approaching the data and the research with preconceived theories and concepts, the researcher begins by first collecting data, conducting a line-by-line analysis, drawing themes from this, then linking it together to create a larger story. A comparison of the incidents leads to the coding of abstract categories, comparing the categories leads to identifying their properties (delimiting), and eventually to more general concepts. The categories are then collated and summarized, thus leading to a theory that has the form of statements about generalized relations among categories. All of this eventually leads to a common thread that runs through grounded theory: constant comparative analysis (Urquhart, 2013). As Glaser and Strauss emphasize, one must take apart the story within the data to generate the theory (Packer, 2011). Grounded theory method analysis is a common qualitative analysis in technology (Myers & Avison, 2002). For example, studies by Joo (2011), Webster and Son (2015), and White and Weatherall (2000) incorporated a grounded theory analysis to study technology. Though traditional grounded theory analysis produces a “theory” from data, grounded theory is also used by researchers to study a process, or may be used solely to analyze the data for theme analysis (Urquhart, 2013). For this study, the grounded theory method will be used to analyze the interviews for theme development to address the research questions.

The first step toward the process of qualitative data analysis is the practice of “coding”. Coding refers to the process of attaching a conceptual label to a piece of data (Urquhart, 2013). Furthermore, as the researcher is coding the data, the coded items should be arranged in a

systematic order. A collection of codes that share attributes form categories, and the beginning of a pattern. Each category that is developed should have a rule for inclusion (Saldana, 2013). From these categories, themes and concepts develop.

The coding of the data was divided into two phases: first cycle coding and second cycle coding. First cycle coding is the initial coding of the data. According to Saldana (2009), there are twenty-four coding methods divided into seven subcategories of first cycle coding methods. Coding the data per each method is not required. Two first cycle coding methods were used: structural coding, and In Vivo coding. These two coding methods are classified under the elemental coding method. Structural coding was chosen because it is appropriate for all qualitative studies, particularly those with multiple participants, and is most suitable for interview transcripts. In Vivo coding was chosen because, similar to structural coding, it is appropriate for all qualitative studies and studies that prioritize and honor the participant's voice, especially that which may be marginalized. Both structural and In Vivo coding are appropriate for grounded theory analysis.

After the First Cycle Coding, the Second Cycle coding was implemented with the goal of developing categories and themes from the First Cycle coding. Open coding and axial coding were the second cycle coding methodology employed. Open coding is one of the first steps into deeper analysis. Tentative labels were created which then become categories. Axial coding focused on the dominant codes and categories formed from the open coding.

### **Reliability and Validity**

Reliability refers to the stability and consistency of the researcher, research tool, and method (Tracy, 2013). For this study, all interviews were conducted by the same individual in order to maintain consistency. Each interview was conducted according to steps directed in the

interview protocol. An interview guide was developed and each participant was asked the same questions (Appendix E).

Qualitative research has standards of quality and approaches to validity (Cresswell, 1998). In fact, validity tends to apply more to quantitative data. In qualitative studies, some researchers refer to verification to assess the accuracy and quality of the study (Creswell, 1998). Creswell (2009) presented eight procedures for verification: prolonged engagement and persistent observation, triangulation, peer review or debriefing, negative case analysis, clarifying researcher bias, members check, thick description, and external audits. Of these eight, it is recommended that at least two be used (Cresswell, 1998).

Triangulation is the practice of using multiple sources, methods, investigation, and theories to corroborate evidence. There are four types of triangulation: data, investigator, theory triangulation and methodological. Triangulation was incorporated in several ways for this study. Methodological triangulation is the process of using multiple methods to study a single problem (Patton, 2002). Methodological triangulation was incorporated with a two cycle coding procedure, each of which used two coding methods. The first cycle coding used two coding methods: structural coding and In Vivo coding. The second cycle coding used open coding and axial coding.

Inter-coder reliability is a type of investigator triangulation that uses several different evaluators or coders (Tracy, 2013; Patton, 2002). Inter-coder reliability is utilized to assess the agreement of the same data when coded by different coders using the same scale, classification, or procedure, in this case, the same codebook and coding methodology (Burns, 2014). Inter-rater reliability is an appropriate technique when all the participants are asked the same questions, in the same order, and the data is coded at the end of all the interviews (Morse, 1997). This study

used an interview guide (Appendix C) in which each participant was asked the same questions in the same order. There are several types of techniques for inter-rater reliability: Cohen's Kappa (categorical data), Spearman rank of correlation (ranked data), and Pearson Product-moment correlation (equal interval data) (Halgren, 2012; Hayes and Hatch, 1999). This study used the percentage of agreement for the larger segment of data in the first cycle coding for validation and reliability before proceeding to the second cycle coding. The researcher coded the data and then a second coder was instructed to code the data with the use of a code book developed by the researcher (see Appendix H). In the NVivo 10 software, there are two ways in which the interview data is organized and coded. When a part of a transcript becomes coded (or placed in a Node), it is indicated that a part of the transcript has been placed in a node and referenced. Figure 5 is a screenshot of the collected nodes and references for the researcher's coding. For Interview1\_1101\_1300, 27 parts of the interview were referenced and placed into 17 "Nodes" or pre-defined codes. Figure 6 is a screenshot of the second coder's coding of the transcripts. The second coder placed 18 parts of the interview into 12 of the "Nodes" or pre-determined codes. The percentage of agreement calculated for the Nodes and References were 70.6% and 78%, respectively. A percentage of agreements was calculated for the 10 interviews (see Appendix J). The average percentage of agreement for the Nodes and References were 86.9% and 81.1% respectively. This means that the researcher and the second coder were coding the data from the transcripts similar to 86.9% for the nodes and 81.1% for the references. It is noted that coders are not expected to agree completely, but should record similar events and classify data in congruency (Harris, Prior, & Adams, 1997).

| First Cycle Coding- Structural    |       |            |
|-----------------------------------|-------|------------|
| Name                              | Nodes | References |
| Interview1_1101_1300__Transcript  | 17    | 27         |
| Interview10_0128_1100__Transcript | 15    | 35         |
| Interview2_1101_1435__Transcript  | 15    | 42         |
| Interview3_1103_1915__Transcript  | 19    | 28         |
| Interview4_1114_1452__Transcript  | 18    | 29         |
| Interview5_1119_1645__Transcript  | 13    | 18         |
| Interview6_1124_1000__Transcript  | 19    | 32         |
| Interview7_1203_1630__Transcript  | 12    | 28         |
| Interview8_1216_1500__Transcript  | 13    | 17         |
| Interview9_0121_1600__Transcript  | 13    | 20         |

Figure 5. The first coder's structural coding results of nodes and references.

| First Cycle Coding-Structural-Second Coder |       |            |
|--|-------|------------|
| Name                                       | Nodes | References |
| Interview1_1101_1300__Transcript           | 12    | 18         |
| Interview10_0128_1100__Transcript          | 17    | 37         |
| Interview2_1101_1435__Transcript           | 17    | 31         |
| Interview3_1103_1915__Transcript           | 22    | 43         |
| Interview4_1114_1452__Transcript           | 21    | 43         |
| Interview5_1119_1645__Transcript           | 14    | 25         |
| Interview6_1124_1000__Transcript           | 16    | 30         |
| Interview7_1203_1630__Transcript           | 15    | 27         |
| Interview8_1216_1500__Transcript           | 12    | 23         |
| Interview9_0121_1600__Transcript           | 13    | 22         |

Figure 6. The second coder's structural coding results of nodes and references.

There are several factors to consider when calculating and interpreting percentage of agreement. This study took into account that the coders were coding similarly to a multiple-choice guessing model, thus their coding was spread uniformly over the alternatives (interview data) (Hayes & Hatch, 1999). However, when incorporating percentage of agreement, chance agreement must be considered (Hayes & Hatch, 1999). The coding and percentage process took into account that the coding calculations could happen by chance due to minimal reliability (Krippendorff, 2011). Furthermore, it must be taken into account that there is not a set significance for percentage of agreement.

Member checking was the second validation strategy used. Member checks is considered the most critical technique for establishing credibility (Cresswell, 1998). The technique of



member checking requests that each participant review a copy of the transcript and a summary of the findings and interpretations of the findings (Vogt, Vogt, Gardner, & Haeffele, 2014). The participants are encouraged to offer any further insight on the transcripts and summary. A two-part member check was conducted for this study. In the first part, the participants were sent transcripts of their interview. Participants were invited to review the transcript, agree or disagree with the findings, and add any additional comments. In the second part of this validation step, the participants received a copy of the results of the data analysis. Participant were invited to review the data. At this time, the participants were welcome to share their thoughts on the themes and other comments. All participants responded to the member check. The member check information was placed in a chart detailing their responses (see Appendix I).

### **Assumptions**

There were several assumptions contained in this research design. A primary assumption is that the information and data collected from the participants is genuine. Another assumption is that the participants used CareZone for the two-week period. Participants were not required to use the app for a specific frequency. Participants were only required to download it; use of the app was then assumed because there was no mechanism to monitor the actual usage of the app by the participants. Also, it is assumed that the CareZone app is representative of the type of healthcare app most applicable to the participants and their needs. Lastly, there is an assumption that the presence of the researcher had no significant influence on the participants to cause them to behave or answer the questions in a specific manner that does not reflect their true intentions.

### **Limitations**

One limitation to the design of the study is the small size of the sample group in comparison to the population of the study. However, this limitation was unique in that the size is key to obtaining a deeper level of response for a qualitative study. This limitation was addressed by the use of screening criteria, which excluded participants who did not have characteristics relevant to the study. Any individual born between 1946 and 1964 qualified for this study. However, the individual had to own a smartphone device with the ability to download the CareZone app. Due to the size of the sample, the results of this study may not be generalizable beyond the scope of the specific population: Baby Boomers in eastern North Carolina.

Another limitation is the possibility of researcher bias during the interview process. Qualitative research should provide new insight or understanding, not report the researcher's beliefs. This limitation was addressed in three ways. First, the researcher opened the interviews by reinforcing a sense of trust and motivated the participants to speak freely of their experiences. Second, an interview guide was used in each session, ensuring that each participant was asked the same questions, but encouraged to speak freely of their experience. Third, the researcher attended "An Engaging Intensive Interview" workshop conducted by Research Talk, Inc. The workshop addressed the topics of ethics, meaning, and co-construction in the interviewing process. The researcher received training to construct and ask in-depth interview questions and become attuned to the participants.

### **Delimitations**

This research employs a qualitative methodology because it lets the researcher uncover salient issues and understand how the Baby Boomer population is interacting with smartphone apps. The sample consisted of participants that were born between 1946 and 1964. Participants were required to have a smartphone device and be willing to use the healthcare app, CareZone.

Grounded theory is the method of analysis utilized for this research. In grounded theory, a systematic inductive analysis of the data is used to develop themes and concepts that eventually compose theories (Tracy, 2013). Grounded theory is the most appropriate analysis for a study of behavior (technology adoption) with an interactional element (smartphone healthcare app use) (Creswell, 2009).

There are numerous healthcare apps available. Some of these are geared towards a specific purpose such as medication tracking only or blood pressure monitoring. The CareZone app was chosen because it offered numerous features such as a medication reminder, calendar, healthcare trackers, and a journal. Because the study did not limit the sample with regard to healthcare status or diagnosis, the CareZone app was chosen because it offered features and services that could be applicable to anyone.

The results of this study could be generalizable to Baby Boomers who have smartphone devices in eastern North Carolina. Generalization to other age demographics may not be warranted.

### **Ethical Assurances**

Approval for this study was obtained from the University & Medical Center Institutional Review Board (IRB) before any data was collected from participants (Appendix D). The participants were subject to an informed consent process to verify that they understood that their participation was voluntary and that they may withdraw from the study at any time. The informed consent, approved by IRB, explained the research project to the participants (Appendix C). Confidentiality was of utmost importance. Each participant was assigned a code and was referred to their assigned code throughout the study. There were no potential conflicts of interest by the researcher in this study.

## **Summary**

Researching the technology adoption behavior of Baby Boomers is important due to the limited number of studies that focus on these particular populations and their adoption of smartphones and healthcare apps. Research recognizes that the maturing population can benefit greatly from healthcare apps; however, if these technologies do not appeal to Baby Boomers, they will not be adopted. This research study attempted to provide new insight into the needs of Baby Boomers and technology. Chapter 4 presents the results of this study and the themes that were revealed.

## **Chapter Four: Results**

Data was collected through interviews and the results that emerged from the grounded theory method analysis provided three themes for understanding the factors that affect Baby Boomers' adoption of healthcare apps for smartphone devices. It is important to note that the themes were grounded in the participants' experiences and opinions. The TAM model was incorporated into this study as a foundation to understand how perceived ease of use and perceived usefulness affect Baby Boomers' adoption of healthcare apps for smartphone devices. In this chapter, the three themes are discussed in light of the current literature, the TAM model, and how they apply to the four research questions mentioned in Chapter 1.

The first part of this chapter presents the demographics of the participants. The second section discusses the development of the themes through the coding process. The third section presents the themes that emerged from the data. The fourth and last section addresses how the themes apply to the four research questions.

### **Participant Demographics**

Ten Baby Boomers, referred to as participants, were interviewed for this study. The participants were residents of eastern North Carolina. Of this ten, three were women and seven were men. The average age of the participants was 59.9 years. All the participants had higher education degrees. Two of them labeled themselves as retired and one participant considered their work status as retired, but working part-time. The seven other participants were employed full-time.

The participants of this study were more educated than the average Baby Boomer. An average of 29.8% of Boomers have completed high school, 28.9% have completed some college and 28.9% have obtained at least a Bachelor's Degree or higher (US Census Bureau, 2006).

Older adults with more education have been linked to using more technology (LaFrance, 2016). A higher level of education is associated with an increase in use of technology and should be considered for the participants of this study. This could indicate that the adults of this study were more apt to use healthcare apps and participate in this study.

Gender has also been considered in this study. Technology perceptions differ between men and women (Gefen & Straub, 1997). Men typically use technology such as computers more and report a feeling of “comfort” in using them (Gefen & Straub, 1997). However, gender is not associated with having an effect on general technology adoption (Amirkhani, Salehahmadi, & Hajialiasgari, 2011). Seven of the ten participants were men, which indicates that the majority of these participants were more apt to use apps; however, this gender difference may not affect the overall adoption.

The average age of the participants were 59.9 years. This age places the average age of the participants into the “Younger” boomer cohort (1956-1965), also known as the Me cohort (Reisenwitz & Iyer, 2007). In general, younger Boomers use technology slightly more than older Boomers. For example, 53% of younger Boomers and 22% of older Boomers own a smartphone, and 25% of the younger Boomers download apps compared to 11% of older Boomers (Rainie, 2012). Due to the average age of the participants, the participants of this study may be more inclined to use innovative technologies. Table 1 shows the demographics for the participants in this study.

Table 1

Demographics of Baby Boomer Participants

| Interview | Year |      | Highest Level of |           |            | Employment |
|-----------|------|------|------------------|-----------|------------|------------|
| Number    | Age  | Born | Gender           | Education | Profession | Status     |

|    |    |      |        |                     |   |                       |
|----|----|------|--------|---------------------|---|-----------------------|
| 1  | 58 | 1957 | Male   | Bachelor of Science | Entrepreneur                            | Full-Time             |
| 2  | 58 | 1957 | Female | Bachelor of Science | Registered Nurse                        | Part-Time             |
| 3  | 57 | 1958 | Male   | Bachelor of Science | Manager                                 | Full-Time             |
| 4  | 69 | 1946 | Male   | Master of Science   | Military/Education                      | Retired               |
| 5  | 53 | 1962 | Female | Associate Degree    | Licensed Practical<br>Nurse             | Full-Time             |
| 6  | 69 | 1946 | Male   | Master of Science   | Military Officer/<br>Telecommunications | Retired/Part-<br>Time |
| 7  | 53 | 1961 | Male   | Bachelor of Science | Network Support                         | Full-Time             |
| 8  | 63 | 1952 | Female | Master of Science   | Director of Christian<br>Education      | Part-Time             |
| 9  | 53 | 1962 | Male   | Associate Degree    | Welder                                  | Full-Time             |
| 10 | 66 | 1949 | Male   | Master of Science   | Pastor/Business Owner                   | Retired               |

### **Coding Analysis and Theme Development**

Saldana (2009) proposed a two cycle coding analysis of qualitative data that is applicable to grounded theory method analysis. The first cycle coding used structural coding and In Vivo coding methods. After the first cycle coding was completed, a two part second cycle coding was conducted using open coding and axial coding. The first phase consisted of an open code process. The data that were coded in the two first cycle methods were read multiple times, compared against each other, and organized into tentative categories. A category emerged from the codes that shared similar characteristics, thus signifying a pattern (Saldana, 2009). Seven categories emerged from the open coding. Table 2 provides a summary of the open code categories that emerged from this phase.

Table 2

Open Code Categories

| Open Code Categories    | Number of Codes | Properties/Description of Code                                 | Examples of Participants Words  |
|-------------------------|-----------------|--|---|
| App Influences          | 37              | Recommendations; Research; Suggestions influencing app choices | “A lot of times, either a friend or I will see, watching on TV or on the Internet, something, and it'll be talking about a particular app. Most of the time I'll say, "Yeah, that works fine. I'll try it out.” (9) |
| CareZone App Experience | 232             | Experience using the CareZone app only; Functions used         | “I've begun to do that. I'm still trying to get to the point where I understand why it would be beneficial to me to log in all of my meds. I have put in a  |



|                                    |    |  |  |
|------------------------------------|----|--|--|
|                                    |    |  | couple of reminders for myself.” (10)  |
| Download Experience                | 11 | Requested help;<br>Description of<br>downloading process                                       | “It was very easy. Went right to the site. I brought it up, first of all, on the iTunes site, hit install and not a problem.” (3)                      |
| Future Use and<br>recommendations  | 83 | Any comments with<br>regard to changes;<br>recommending to peers,<br>description of ideal app. | put in that you would just be able to have an easier way to update your med list and edit your instructions, that kind of thing when they change.” (5) |
| Prior Healthcare App<br>experience | 37 | Prior knowledge or<br>experience of<br>healthcare apps.  | “All of my healthcare providers have some app that they use to store my healthcare information, give me  |

|  |     |   |  |
|--|-----|---|--|
|  |     |   | reminders of<br>appointments. They<br>give me a history of all<br>my visits and the things<br>that were determined<br>during those visits.” (6)                            |
| General Smartphone<br>Experience and<br>Smartphone app<br>Experience | 129 | Experience with<br>smartphone,<br>smartphone apps;<br>Experience concerning<br>technology in general. | “Normally I'm not<br>really a phone person”<br>(7)   |
| Types of Apps Used   | 49  | Apps used by the<br>Participants  | “The apps I use the<br>most are probably<br>camera editing, but I<br>also have apps for news<br>and weather and voice<br>mail, Facebook,<br>calendar, Google<br>maps.” (1) |

After the open coding process, axial coding was conducted to identify relationships among the codes and the categories that formed during the open coding. The primary purpose of axial coding is to determine which of the codes were dominant. This was done by reorganizing

the data, removing redundant codes, eliminating codes that were not significant, and choosing codes that were the best representatives of the data (Saldana, 2013). Six axial coding categories emerged. Table 3 summarizes these six categories.

Table 3

Axial Code Categories

| Axial Code and Number of |       |  |  |
|--------------------------|-------|--|--|
| Category                 | codes | Category Properties  | Examples of Participants' Words  |
| Communication            | 5     | Communication with family, friends, etc.; Using technology for communication                         | “Someone told me about an app that was free and that it was easy to use, that kind of thing.” (5)  |
| Assistance               | 6     | Asking, receiving, needing help or assistance with using smartphones, apps, or technology in general | “I think it's my age. I didn't grow up using computers and so, anything that's easier that I can ... I don't have to sit and ask any of my children to do ... I feel like can figure out myself and it's that's what useful is to me. Easy to download, easy access to information.” (8) |
| Independence             | 3     | Desiring independence, remaining independent in use of technology                                    | “Am I going to have to try to get somebody to help me?” (2)  |

|                      |    |  |  |
|----------------------|----|--|--|
| Learning<br>Behavior | 41 | How participants learn to use<br>technology; Cognitive<br>Processes  | “People of my generation, we want<br>to know before we do, and we’re<br>not into the habit of learning while<br>you do.” (4)   |
| Need and<br>Purpose  | 42 | Comments of need and purpose; “The insurance we have at work is<br>Reasons for using an app related<br>to purpose. | possibly going to change, and an<br>app like this is definitely what I<br>would need... I forget what you<br>call it, but we're going away from<br>the copay where you pay first.<br>Whatever you call that kind of<br>insurance, so I definitely would<br>need an app to help maintain all<br>the payments and the deductibles.”<br>(9) |
| Relationships        | 23 | Interactions with others   | “I’m always asking persons that I<br>know which ones that they use<br>most of all and what's helpful to<br>them.” (10)   |

Four dominant categories emerged from the following six categories: need and purpose, learning approach, assistance, and independence. Learning approach and need and purpose were associated with 41 and 42 codes respectively. Assistance and independence were initially two

separate categories; however, these two categories were later merged into one. These categories were combined because further analysis revealed that the data from the category of independence was in reference to needing and requesting assistance with using apps. The categories of communication and relationships did not provide significant data. From these four categories, three themes emerged. Table 4 represents the categories and subsequent themes that emerged from the data.

Table 4

Theme Development

| Category                        | Theme   |
|---------------------------------|---|
| Need and Purpose                | Baby Boomers Utilize Apps for a Present Need that Serve a Purpose for that Need       |
| Learning Approach               | Baby Boomers' Learning Behavior affects their adoption of apps.                       |
| Independence<br>+<br>Assistance | Baby Boomers desire to maintain independence and not seek assistance when using apps. |

**First Theme: Baby Boomers Utilize Apps for a Present Need that Serve a Purpose for that Need.**

The theme that Baby Boomers tend to adopt and desire smartphone apps that have a purpose or address a need in their life emerged from the category of need and purpose. As a participant commented about choosing an app, “There has to be something I need” (7). This theme was revealed through two parts of the analysis.

In the first cycle structural and In Vivo coding, data responses were coded according to the type of smartphone apps that were used by the participants within the code: “Types of Apps Used by Baby Boomers”. This code was developed from the interview guide that inquired of the type of apps the participants used when describing their smartphone experience and usage.

Apps are categorized according to two types of services: information based services and entertainment-oriented services. Information services, also recognized as services that create a high utilitarian value, include apps such as education, healthcare, medical, news, reference, weather, search services, business, finance, productivity, and utilities (Kim, Park, Kim, & Lee, 2014). The utilitarian value of an app is determined by the extrinsic motivation for a goal directed need (Heinonen & Pura, 2008).

Entertainment-oriented services are also classified as hedonic services. Hedonic services are of an intrinsic motivation and are for fun or an enjoyable service (Heinonen & Pura, 2008). Entertainment-oriented services or hedonic service apps include games, books, music, leisure related services (example: sports, travel, and lifestyle), and social networking (Kim, Park, Kim, & Lee, 2014).

The ten participants named a total of 49 apps that they used on a consistent basis. Of these apps, 31 (63%) were classified as information or utilitarian (Table 5). 18 of these apps (36%) were classified as apps for entertainment purposes. The Baby Boomers of this study used information apps almost double that of entertainment apps. Of the 49 types of apps used by the ten participants, 31 were for an information-based services. This also means that many of the apps chosen in this study had a utilitarian value. Utilitarian service apps are also those that were characterized by increasing effectiveness, saving time, and providing information. These

characteristics of utilitarian apps were described concisely by participant 6 who described the ideal app as being a source of information that saves time, effort, and energy.

Table 5

App Classification among Participants

| App Classification      | App Types          | Number Used Per Participants |
|-------------------------|--------------------|------------------------------|
| Information/Utilitarian | Productivity       | 6                            |
|                         | News               | 6                            |
|                         | Utilities          | 5                            |
|                         | Reference          | 5                            |
|                         | Navigation         | 3                            |
|                         | Business           | 2                            |
|                         | Health and Fitness | 2                            |
|                         | Finance            | 2                            |
| Entertainment/Hedonic   | Travel             | 4                            |
|                         | Lifestyle          | 4                            |
|                         | Photo and Video    | 4                            |
|                         | Social Networking  | 3                            |
|                         | Music              | 2                            |
|                         | Games              | 1                            |

Note. Adapted from Kim, J. Y., Park, C. K., & Lee, H. (2014). Mobile application service networks: Apple's App Store. *Service Business*, 8, 1-27.

This theme was further supported in the second cycle coding phase. Seven of the ten participants (Participants 2, 5, 6, 7, 8, 9 and 10) voiced that a need was their primary reason for using an app. However, also noteworthy is that this “need” did not refer strictly to a specific object or activity. Baby Boomers also factor in the frequency of the need to use the app. One Baby Boomer described that their choice in an app was influenced by how often would they need that app: “Frequency of need...I think for me, when I use an app, it's something that I'm going to probably use every day” (8).

Just as having a need was a reason to use an app, participants shared that the absence of a healthcare need was their reason for not incorporating the CareZone app into their daily regimen at the end of the study. Some participants shared that not having a medical need was highly influential in their use of the Carezeone app. As participant 9 shared, “I wouldn't say I really need an app since I'm blessed with good health...I don't really need one [a healthcare app] at this point.”

Overall, Baby Boomers use apps that have a purpose, and this theme is supported by the type of apps that the participants used and their stated reasons for using or not using an app. As a participant concisely stated: “Mainly, I'm very much a functional person, so it [an app] has to have a good function, a purpose, for what I'm gonna do. Not just for the fun of it” (3).

**Second Theme: The learning approach of Baby Boomers affects their adoption of apps.**

The theme that the learning approach of Baby Boomers affects their adoption of apps emerged from the category of learning behavior. Learning approaches address how one acquires and modifies knowledge, skills, strategies, beliefs, attitudes, and behavior (Schunk, 2012). The category of learning approach reflects that Baby Boomers have a unique learning behavior that affects their use and adoption of technology such as smartphone apps. Also, each learning



approach is specific to a generation and is based on the generation's values, ideas, ethics and culture (Johnson & Romenello, 2005). The participants of this study were aware of this difference and shared their thoughts. The participants viewed the younger age demographics to be more apt at understanding new technologies and were mindful of this difference in learning when they were attempting to adopt a new technology. Baby Boomers commented:

“I'm just in that age.” (2)

“We learn in different ways.” (4)

“I think it's my age. I didn't grow up using computers...” (8)

Hence, Baby Boomers are aware that technologies such as smartphones and smartphone apps are not created with them (Baby Boomers) in mind.

Baby Boomers' unique learning approach was also evident as the participants shared comments relating to how they acquire knowledge and skills. Baby Boomers desired to know the framework and the end result of the app before using the app. Participant 4 concisely stated, “People of my generation, we want to know before we do, and we're not into the habit of learning while you do.” Hence, this theme connects with the category of a need or purpose, because Baby Boomers are more likely to download an app that they need and therefore, have an assumption of the app's purpose.

Though the Baby Boomers in this study were aware of the difference related to age with regard to learning approach, the participants were very open to share how they best acquire new knowledge and skills. One Baby Boomer shared, “I'm good with words and pen and paper and that kind of thing” (2). Another shared this sentiment: “I've tried and read and try to master that which is in writing.” Participants shared changes and recommendations to the app that would make it more applicable to their learning approach. Participants recommended a user manual,

something to download and print, a tutorial, and instructions on how to use it. A promising note is that the participants of this study wanted to know how to use the apps and become more apt at using the CareZone app. Regarding learning approaches, the participants knew how they learned best, and from their recommendations, were eager for technologies that would consider their learning approach.

### **Third Theme: Baby Boomers desire to maintain independence when using apps.**

The theme that Baby Boomers desire to maintain independence when using apps emerged from the combination of two categories: independence and assistance. Further analysis of the two categories revealed that the participants spoke of independence strictly with regard to using the app and needing assistance with the app. This theme does not refer to maintaining independence within life in general. Baby Boomers desire to remain independent in their use of technology such as smartphone apps. Though many of the influencers for app choice were family members and friends, Baby Boomers revealed a desire to remain independent of these individuals when using smartphones and apps. As an example, a participant explained that a technology was considered useful and easy if they didn't have to ask their children for help in using the technology. Furthermore, a Baby Boomer may not adopt the app if they need a lot of assistance in using and understanding the app. Participant 2 revealed that if the process of using the app was stressful and would require a lot of assistance, then they simply would not use the app. Another participant commented that when they are unable to understand an app, they resort to asking for help. However, this was not the ideal choice, as the participant shared, "I'm not that crazy about asking for help" (4). This theme reveals that if a Baby Boomer cannot maintain their independence in using the app, the adoption of the app may decrease.

## **Application to Research Questions**

This research study presented four research questions to understand the adoption of healthcare apps for Baby Boomers. The following section discusses the four research questions and how the categories and themes applied to each question.

The first question was: Do Baby Boomers who have experience using at least one healthcare app for smartphones perceive healthcare apps for smartphones to be useful to their healthcare? The category of need and purpose and the theme that emerged from that category, Baby Boomers utilize apps for a present need that serve a purpose for that need addressed this research question. Within the TAM model, perceived usefulness is associated with the idea of a purpose (Davis, 1993). Perceived usefulness is explained as contributing a purpose to an individual's activity and having an impact on the user's routine (Davis, 1993). The Baby Boomers of this study did perceive healthcare apps for smartphones as useful to their healthcare when they had a healthcare need. For example, the most used feature of the CareZone app was the medication reminder. As many of the participants were taking medications for some healthcare-related need, they utilized this feature the most and consequently, this was the feature they deemed the most useful. Also, the CareZone app provided a feature that tracks blood pressure and blood glucose; however, this feature was only mentioned by participants with hypertension and diabetes, respectively. These tracker features were used because the participants had a need for them.

A lack of attention to the user's needs is associated with a decreased rate of technology adoption (Thielke et al., 2012). Studies by Melenhorst (2001), Steel, Lo, Secome, and Wang (2009), and Walsh and Callun (2010) revealed that older adults prefer technology that provides for a need, and are reluctant to adopt a technology if they cannot foresee the advantage of using

it. This was evidenced by the participants in the study. The absence of a healthcare need was the primary reason three of the ten participants would not continue to use the app after the study. As developers create apps for the Baby Boomer populations, they should keep in mind that the purpose of the app addresses their needs.

The second research question inquired if Baby Boomers who have experience in using at least one healthcare app for smartphones perceive healthcare apps for smartphones to be easy to use. The theme regarding the learning approach of Baby Boomers addresses this question. The factor of perceived ease of use from the TAM model was the foundation for this question. Davis (1993) defined perceived ease of use as the “degree to which an individual believes that using a particular system would be free of physical and mental effort.” The reference to mental effort was key to addressing this question. If a technology, such as a smartphone app, is not tailored to the user’s learning approach, there is an increase in mental effort to understand and use the app. If the mental effort needed to use the app increases, the ease of use of the app decreases, and the app cannot be considered easy to use. An app that does not consider the Baby Boomer’s specific learning approach will consequently increase the mental effort of the Baby Boomer attempting to use the app. Subsequently, this increase of mental effort decreases the ease of using the app. This will lead to a decrease in adoption of the app. Two of the three aspects of technology adoption that challenge researchers, as detailed by Straub (2009) support this theme: (1) technology adoption is a complex, social, and developmental process, and (2) successful technology adoption must address cognitive, emotional and contextual concerns.

To increase the adoption of healthcare apps among Baby Boomers, the learning approach of the Baby Boomer must be considered as a factor that influences how easy it is to use a healthcare app. Learning approaches differ among age demographics. Baby Boomers do not

learn by self-teaching and prefer a lecture style setting with note taking, handouts, and asking questions of the faculty (Johnson & Romanello, 2005). This is in contrast to members of Generation X and Millennials. Members of Generation X prefer to work independently and are at ease with distance education courses and Millennials prefer group activities and personal learning tactics (Johnson & Romanello, 2005). Hence, members of Generation X and Millennials will be able to learn how to use an app independently; however, a Baby Boomer that is not conducive to self-learning may have some difficulty in teaching themselves how to use an app. Consequently, participants of this study shared that having something in writing, taking notes, or having a reference for the CareZone app in the form of a manual or downloadable instructions would have made the CareZone app easier to use.

Another learning approach specific to Baby Boomers is the desire to know the context of what they are learning and the requirements for the final result (Steel & Gray, 2009). For example, a study revealed that Baby Boomers in the classroom setting, when given a syllabus, will immediately seek to know the requirements for the grade (Johnson & Romanello, 2005). Participants of the study also shared a desire to know the end result of the app or the expectations of the app prior to using it. A healthcare app that is easy to use by Baby Boomers should have instructions that are available in a written form and the purpose should be communicated up front. This would decrease the user's mental effort, increase the ease of use, and increase the adoption of the app.

Providing technical support, developing in-person training, and providing written manuals address the ways that Baby Boomers learn (Lee & Coughlin, 2015). A participant shared a comment that embodied this concisely: "When I think of functionality, I am thinking of how easy it is to understand, to use it the first time and that it operates seamlessly, without

glitches...that it is intuitive in design. The graphics are clear and easy to understand and follow prompts and things work logically” (1).

Question three inquired if Baby Boomers perceive healthcare apps for smartphones as a technology that they are willing to add to their healthcare regimen. This question is also addressed by the category of need and purpose and the theme that Baby Boomers utilize apps for a present need that serve a purpose for that need. As Baby Boomers age, their risk of developing a chronic disease increases, which consequently increases the need for physician visits, prescribed medications, and health monitoring (Eysenbach, 2014). From the findings of this study, Baby Boomers are more inclined to use healthcare apps when they have a need and purpose for the technology. Therefore, as Baby Boomers mature and health-related changes occur, they will develop a need for healthcare apps. Hence, according to the findings of this study, with a healthcare need present, Baby Boomers will be willing to use a healthcare app, since it is needed.

When addressing the question of adding the app to their healthcare regimen, seven of the ten participants were willing to add the app to their healthcare regimen and continue using it in some capacity. These participants were utilizing the app for some health-related need such a medication reminders or blood pressure tracking. However, the other three participants commented that they probably would not continue to use the app because they did not have a need for the app and it did not serve a purpose. These three participants did not take any medications and stated that they were in “good health.”

Question four inquired of the factors that Baby Boomers report would increase their adoption of healthcare apps for smartphones. All of the categories and subsequent themes from the study address how to increase healthcare app adoption for Baby Boomers. The rate of

adoption of a healthcare app increases within the Baby Boomer population when there is a healthcare need and the app serves a purpose for that healthcare need. The rate of adoption also increases if it does not increase the mental effort of the participant and addresses the learning behavior of Baby Boomers.

In addition, Baby Boomers desire to be independent in using healthcare apps. This theme emerged from the categories of independence and assistance. There is an increase in the rate of adoption of a technology if it allows an older adult to remain independent, maintain control, and continue to have control and authority of the technology's features and functions (Lee & Coughlin, 2014). This need to stay independent has important implications for the design and delivery of a technology. Though a technology can have numerous benefits for a user's health, well-being, and quality of life, if the technology does not address the importance of maintaining independence, the technology has not addressed the desire of the Baby Boomer and older users (Thielke et al., 2012). Though members of younger generations may assume that older adults are receptive to offers of help with understanding technology, research reveals that as people age, they seek to maintain their independence (Wilson & Mitchell, 2009). The participants viewed requesting help as frustrating and an inconvenience to others. As participant 2 stated, "If it's necessary, then I'll have to bug somebody to help me, which gets old." Participant 8 agreed with this theme in response to the member checking review of the results: "I especially like your findings about maintaining independence. I think that's so important to people as they grow older."

The themes that emerged from this study also compare to a study conducted by Lee and Coughlin (2015), who identified ten factors that affect older adults' adoption of a technology. Table 6 lists these ten factors and provides a brief description. These ten factors were derived

from a review of 59 articles that resulted from a database search using the terms “older adults”, “technology adoption”, and “technology acceptance.” The 59 articles were all published within the last 17 years. The top two factors were value and usability. Value refers to the perceived usefulness and potential benefit of a technology. In this study, perceived usefulness is associated with purpose and need. The factor of usability describes the perceived user-friendliness and the ease of learning the technology. This factor supports the themes of the learning approach. Independence was the eighth factor and is described as the social visibility of a technology or how it makes them look to others. Though the methodology and sample size is a limitation of the study, the 59 articles reviewed by Lee and Coughlin further support that the three themes from this study have relevance in the current research of Baby Boomers and their adoption of technology.

Table 6

Ten Factors Influencing Older Adults’ Technology Adoption

| Factor            | Description   |
|-------------------|---|
| Value             | Perception of usefulness and potential benefit                                |
| Usability         | Perception of user friendliness and ease of learning                          |
| Affordability     | Perception of potential cost savings  |
| Accessibility     | Knowledge of existence and availability in the market                         |
| Technical Support | Availability and quality of professional assistance throughout use            |
| Social Support    | Support from family, peers, and community                                     |
| Emotion           | Perception of emotional and psychological benefits                            |
| Independence      | Perception of social visibility or how a technology makes them look to others |



|            |   |
|------------|---|
| Experience | Relevance with their prior experiences and interactions |
| Confidence | Empowerment without anxiety or intimidation             |

Note. Adapted from Lee, C. & Coughlin, J. (2015). Perspective: Older Adults' Adoption of Technology: An Integrated Approach to Identifying Determinants and Barriers. *Journal of Innovative Management*, 32, 747-759.

## Discussions

The themes that emerged from this study correlate with both the foundations of the TAM model and the current, emerging literature. Perceived ease of use and perceived usefulness of the TAM model that were developed approximately 30 years ago provided a foundation for understanding the healthcare app adoption behavior of the Baby Boomers in this study. This study revealed how these two factors affect healthcare app adoption. The study further revealed how these factors impacted Boomers' adoption behavior.

In conclusion, the results of this study are opportune for the current issues facing the nation. In 2014, digital health funding doubled to over \$4 billion from 2013. Venture capitalists invested over \$630 million to this \$4 billion budget (Wang, King, Perman, & Tecco, 2015). Government incentives are also predicted to increase the development and use of apps. In 2015, Medicare introduced a CPT code for telehealth reimbursement (Telecommunications, 2014). In the same year, IBM partnered with Apple to provide iPads to over 5 million older adults in Japan. Many of these devices came pre-loaded with health apps.

These factors are growing evidence of the awareness and need of health-centric technologies to assist Baby Boomers. Factors such as more focused research, willing users, increased sponsorship by agencies and physicians, and increased funding will increase the development of apps and technology geared towards the needs of Baby Boomers. However, to

provide the technology that will be utilized by Baby Boomers, research must be conducted to understand how best to address their needs.

## **Chapter Five: Conclusion and Future Work**

This research project identified the major factors that affect the adoption of healthcare apps for smartphone devices among the Baby Boomers in Eastern North Carolina. Perceived ease of use and perceived usefulness, two factors of TAM, were used as a theoretical foundation to explore the factors associated with technology adoption. A qualitative research approach utilized interviews as the method of data collection. The grounded theory method (GTM) was used to analyze the interviews. From GTM, three themes emerged that not only addressed how perceived ease of use and perceived usefulness affect healthcare app adoption, but also provided a deeper interpretation of how these factors can be explored and studied to address technology adoption of healthcare apps for the Baby Boomer population. This chapter provides a discussion of the research results by relating them to the research objectives and questions, and giving an account of the main implications of the research findings. A future work section addresses how the themes and findings from the study can be applied to future research.

### **Discussion of the Findings and Implications**

The Baby Boomers are a noteworthy generation. The surge of births that would give rise to this generation resulted after America's victory in the Second World War and the resulting nationwide prosperity. Baby Boomers came of age during a time of unprecedented economic growth and were pivotal witnesses and participants in a time of significant social, cultural, and political change. Thus, Baby Boomers have had a significant impact on America in many ways besides the sheer size of their numbers. Therefore, as Baby Boomers mature and enter a new phase, it can only be expected that they will have just as strong of an influence.

There are numerous areas in which Baby Boomers are predicted to have a significant impact. As Baby Boomers retire, the workforce will decrease and federal and personal

retirement fund distribution will commence. This is expected to affect the financial and employment sectors tremendously. Regarding health, Baby Boomers are living longer, but are also at an increased risk for developing chronic diseases that will need medication management, increased physician visits, and lifestyle changes. This will have a significant impact on the healthcare community, eventually trickling into other areas.

Smartphones and healthcare apps are one innovative solution to this challenge. The four research questions of this study set forth to explore the factors that influence the adoption of healthcare apps for smartphone devices among the Baby Boomer generation. This study's sample included 10 Baby Boomers from eastern North Carolina who shared their thoughts and opinions on smartphones and healthcare apps for a qualitative research study. The interview data that was obtained was analyzed by a grounded theory method analysis. This analysis provided three prominent themes of healthcare app adoption among Baby Boomers.

Two of the research questions of the study were anchored in two components of the TAM model: perceived ease of use and perceived usefulness. These two factors are significant in predicting the adoption of an innovative technology. Indeed, ease of use and usefulness did prove to be pivotal factors in the adoption of healthcare apps for the Baby Boomers in this study. However, the themes revealed that technology adoption isn't simply defined as the technology being "easy to use" or "useful." The study revealed that these two factors are an umbrella for a deeper understanding of adoption.

Perceived ease of use (or easy to use) was supported with the themes of learning approach and independence/assistance. What makes an app easy to use? There are numerous possibilities. However, this study revealed that how Baby Boomers approach learning is significant in their judging the ease of use of a healthcare app. The learning approach is a

collection of ethics, behaviors, attitudes, and strategies that influence how a new skill is adopted. Learning approaches differ individually and within a group, such as an age demographic. The app market is dominated by developers that are of Generation X and Millennial age demographics (Dugdall, 2010). It is highly unlikely that members of these generations are developing apps that are considerate of the learning approach of Baby Boomers. Though healthcare apps are predicted to be able to aid Baby Boomers in their healthcare needs, if the developers do not understand the learning approach of the Baby Boomers, the apps will not be easy to use and adoption of the technology decreases. The theme of learning approach from this study can have a significant contribution to app development. Developers of healthcare apps must consider how Baby Boomers will learn to use the app and develop apps accordingly. From the participants of this study, developers should ensure that the purpose of the app is easy to grasp and not revealed as the Baby Boomer uses the app. The participants of this study and the research reveals that Baby Boomers want to know the purpose and framework of the app prior to using. In addition, the availability of the instructions is another factor. Research indicates that Baby Boomers learn through note taking and lectures. The Baby Boomers of this study commented on their preference to write. Another participant requested a manual or printable instructions for the CareZone app.

The themes of independence and assistance are also aspects within the ease of use factor. As Baby Boomers age, they wish to remain as independent as possible in using technology. It is at this junction of independence and assistance that assumptions muddle technology among the generations. Younger generations assume that older generations are welcoming of assistance, while older generations desire to remain independent of the younger generations in technology use. Are Generation X and Millennial app developers creating apps assuming that any

difficulties encountered by older generations can be remedied by children and younger associates? Apps must be developed that are easy for Baby Boomers to use. The more an app allows a Baby Boomer to remain independent, the easier it is to use, and the rate of adoption increases.

The research question with regard to Baby Boomers and their perception of usefulness of healthcare apps was addressed by the theme of purpose and need. The participants of this study utilized apps that had a purpose. This was reflected in the first coding analysis of the type of apps used by the Baby Boomers and in the theme that developed in the second coding. More than half of the apps used by the participants were for an information and utilitarian purpose. As Baby Boomers develop chronic diseases that require medications, there will be a need for technologies such as healthcare apps that address this need. The CareZone app used in this study offered numerous features such as medication reminders, medication trackers, and a calendar that could be utilized in many ways. One feature that was unique to this app and in turn served as a unique purpose to the needs of Baby Boomers was the ability to add profiles of other people, such as a parent, and share that profile with people such as a sibling or caretaker. Many Baby Boomers are taking care of aging parents and this feature allows them to organize and track their parents' health. One participant commented that they wished they had this app when taking care of a deceased parent. This is an example of a technology connecting the usefulness of its product to the needs of its users. The technology industry, specifically the healthcare-related sector of technology, will need to consider all the current and future needs of the Baby Boomer population. This will be a dynamic progress as Baby Boomers continue to mature and their needs change.

The two remaining questions addressed the willingness of Baby Boomers to add healthcare apps to their healthcare regimen, and the factors that would increase their adoption of healthcare apps. Baby Boomers are willing to add healthcare apps to their healthcare regimen when they have a need and the app serves a purpose for that need. Reviewing apps for this study, the CareZone app was chosen because it offered numerous features that could be used for various needs. However, the primary feature used was the medication reminders. Baby Boomers are at an increased risk of developing chronic disease, and medication therapy is the primary means of chronic disease management. There are apps that are available strictly for medication management. For some users, a specific app may be more appealing. However, for some, an all-encompassing app may be deemed more useful. Regardless, as Baby Boomers age and develop different healthcare needs, the type of healthcare apps needed also change. Developers will need to stay abreast of these changes and create apps accordingly.

Factors that increase Baby Boomers' adoption of healthcare apps were explained through the themes regarding learning behavior and independence/assistance. In addition, developers should also consider the vision and motor coordination of the users. The participants shared comments that the CareZone app did not take into consideration the physical changes related to the aging process. For example, one participant commented that the feature screen was too monochrome. Another commented that due to their decreasing vision, the screen was not ideal. Though the app allows the participants to take pictures of their medication bottles to collect information, some participants commented they had to take several pictures due to shaky pictures related to decreases coordination.

## **Future Work**

The insights shared by the participants are part of the advantages of doing a qualitative study. A qualitative methodology allows the researcher insight into activities and beliefs that could be missed in a structured survey or experiment. A benefit of qualitative research and grounded theory is that it provides an abundance of data that can be used for future studies and publications. In addition, qualitative research is not isolated from quantitative methods. Qualitative research can discover salient issues that can then be studied in the future within a quantitative methodology.

The analysis of this data formulated three themes for this study. However, there were other aspects of this data that could be focused upon to further explore factors that affect Baby Boomers' adoption of technology. For example, the social aspects of technology adoption among Baby Boomers could be further studied. Though a theme from this data did not emerge, relationships were an emerging factor in influencing the app choices of Baby Boomers. The participants commented on 37 types of influences for their app choice. Of these 37 influencers, 72% (27) were through a personal relationship such as a child, sibling, spouse, or friend.

This study identified learning approach as a category and theme that influences healthcare app use and adoption. Future studies could investigate the most appropriate learning approaches for Baby Boomers considering healthcare apps. This information could be used in developing healthcare apps that are easier for Baby Boomers to use.

This study focused on Baby Boomers that had smartphones. However, there were several Baby Boomers that were informed of the study, but could not participate because they did not have a smartphone. Unfortunately, data was not collected on these individuals. Future studies could seek to explore this sect of the Baby Boomer population. As smartphones and healthcare



apps are predicted to become a factor in improving the quality of life of Baby Boomers, understanding this section is invaluable.

The focus of this study was Baby Boomers of eastern North Carolina and their technology adoption behavior for healthcare apps. Insightful information about Baby Boomers and their adoption needs and behavior was collected. However, the themes that were developed provided insight into what Baby Boomers deemed as “useful” and “easy to use.” Other populations may associate different meaning and values to these two factors of the TAM model. Further studies could investigate how perceived usefulness and perceived ease of use is described among other populations. This information could then be used to develop apps and other technologies that could increase the technology adoption of other populations and products.

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APPENDIX

APPENDIX A: IRB APPROVAL



**EAST CAROLINA UNIVERSITY**

**University & Medical Center Institutional Review Board Office**

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Notification of Initial Approval: Expedited

From: Social/Behavioral IRB  
To: [Annie Patrick](#)  
CC: [Erol Ozan](#)  
Date: 8/24/2015  
Re: [UMCIRB 15-000510](#) Baby Boomers Adoption of Smartphone Healthcare Apps

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 8/24/2015 to 8/23/2016. The research study is eligible for review under expedited category # 6, 7. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

| Name                                  | Description                             |
|---------------------------------------|---|
| AYPatrick_Interview Protocol.docx     | Interview/Focus Group Scripts/Questions |
| AYPatrick_Proposal.docx               | Study Protocol or Grant Application     |
| AYPatrick_Survey.docx                 | Surveys and Questionnaires              |
| Informed Consent Document_Patrick.doc | Consent Forms                           |

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

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IRB00000705 East Carolina U IRB #1 (Biomedical) IORG0000418  
IRB00003781 East Carolina U IRB #2 (Behavioral/SS) IORG0000418

## APPENDIX B: CAREZONE APP USAGE APPROVAL

Reply all | Delete | Junk | ...



### Your inquiry



David Spitzler <david@carezone.com>

To: Patrick, Annie Yong



Reply all |

Mon 03/09/2015 07:05 PM

Thesis

You replied on 12/22/2015 06:42 PM.

Hi Annie,

We would be delighted to have you use CareZone as a part of your thesis. You are free to use the app, as the app is in fact free, and as long as you comply with the terms of service, you are good to go.

Is there anything else you need from CareZone?

Our only requirement is to receive a copy of your thesis when it's finished.

Best of luck with your research!

David

--

David Spitzler  
Head of Business Development  
CareZone: For Your Family Life  
(415) 225-7787



## APPENDIX C: INFORMED CONSENT TO PARTICIPATE IN RESEARCH

*East Carolina University*



### **Informed Consent to Participate in Research**

Information to consider before taking part in research that has no more than minimal risk.

Title of Research Study: Baby Boomers' Perception of Healthcare Apps for Smartphone Devices

Principal Investigator: Annie Y. Patrick

Institution, Department or Division: Department of Network Technology Systems

Address: Science and Technology Building, Suite 201, Greenville, NC 27858-4353, USA

Telephone #: 912-660-3072

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Researchers at East Carolina University (ECU) study issues related to society, health problems, environmental problems, behavior problems and the human condition. To do this, we need the help of volunteers who are willing to take part in research.

#### **Why am I being invited to take part in this research?**

The purpose of this research is to study individuals that were born between 1946-1964 and their perception of healthcare apps for smartphones. You are being invited to take part in this research because you were born between the years 1946-1964 and have a smartphone. The decision to take part in this research is yours to make. By doing this research, we hope to learn the perception of healthcare apps on smartphone devices used by baby boomers of retirement age.

If you volunteer to take part in this research, you will be one of about 8 people to do so.

**Are there reasons I should not take part in this research?** There are no reasons to not participant in this research.

#### **What other choices do I have if I do not take part in this research?**

You can choose not to participate.

#### **Where is the research going to take place and how long will it last?**

The research will be conducted at either an East Carolina University facility, local public library, or agreed upon public location. You will need to come to come to one of these locations two times during the study. The total amount of time you will be asked to volunteer for this study is 60-90 minutes over the next 3 months.

#### **What will I be asked to do?**

You will be asked to do the following: You will be given a 10 question survey. You will be asked to download the app, CareZone onto your smartphone device. We as that you use it for a two week period. After the two week time-period, you will participant in a 60-90 minute interview. The

interview will consist of questions pertaining to your perception and experience of the app. The interview will be recorded and will be only reviewed by the researcher.

**What might I experience if I take part in the research?**

We don't know of any risks (the chance of harm) associated with this research. Any risks that may occur with this research are no more than what you would experience in everyday life. We don't know if you will benefit from taking part in this study. There may not be any personal benefit to you but the information gained by doing this research may help others in the future.

**Will I be paid for taking part in this research?**

We will be able to pay you for the time you volunteer while being in this study. One (1) \$10.00 Visa Gift Card will be given to you at the end of your participation

**Will it cost me to take part in this research?**

It will not cost you any money to be part of the research.

**Who will know that I took part in this research and learn personal information about me?**

ECU and the people and organizations listed below may know that you took part in this research and may see information about you that is normally kept private. With your permission, these people may use your private information to do this research:

- Any agency of the federal, state, or local government that regulates human research. This includes the Department of Health and Human Services (DHHS), the North Carolina Department of Health, and the Office for Human Research Protections.
- The University & Medical Center Institutional Review Board (UMCIRB) and its staff have responsibility for overseeing your welfare during this research and may need to see research records that identify you.

**How will you keep the information you collect about me secure? Data will be stored in the Department of Technology System's Pirate Drive. How long will you keep it?** The data will be kept for 3 years.

**What if I decide I don't want to continue in this research?**

You can stop at any time after it has already started. There will be no consequences if you stop and you will not be criticized. You will not lose any benefits that you normally receive.

**Who should I contact if I have questions?**

The people conducting this study will be able to answer any questions concerning this research, now or in the future. You may contact the Principal Investigator at 912-660-3072 (Monday-Sunday, between 8 a.m.-5 p.m.).

If you have questions about your rights as someone taking part in research, you may call the Office of Research Integrity & Compliance (ORIC) at phone number 252-744-2914 (days, 8:00 am-5:00 pm).

If you would like to report a complaint or concern about this research study, you may call the Director of the ORIC, at 252-744-

**Are there any Conflicts of Interest I should know about?**

The Principal Investigator (or the sub-investigator, research staff member, or family member) has a potential conflict of interest that involves (provide a brief description of the conflict). (ECU, institution's name or office name) and (name or title of person with conflict) have developed a management plan to minimize any negative impact that would otherwise occur from the potential

conflict of interest. This plan has been reviewed by the University & Medical Center Institutional Review Board and found to be adequate to protect your rights.

**I have decided I want to take part in this research. What should I do now?**

The person obtaining informed consent will ask you to read the following and if you agree, you should sign this form:

- I have read (or had read to me) all of the above information.
- I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answers.
- I know that I can stop taking part in this study at any time.
- By signing this informed consent form, I am not giving up any of my rights.
- I have been given a copy of this consent document, and it is mine to keep.

---

|                                   |                  |             |
|-----------------------------------|------------------|-------------|
| <b>Participant's Name (PRINT)</b> | <b>Signature</b> | <b>Date</b> |
|-----------------------------------|------------------|-------------|

**Person Obtaining Informed Consent:** I have conducted the initial informed consent process. I have orally reviewed the contents of the consent document with the person who has signed above, and answered all of the person's questions about the research.

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|   |                  |             |
|---|------------------|-------------|
| <b>Person Obtaining Consent (PRINT)</b> | <b>Signature</b> | <b>Date</b> |
|---|------------------|-------------|

## APPENDIX D: CAREZONE APP

The screenshot shows the CareZone website with a navigation bar at the top. The main content area is divided into a grid of feature cards, each with an icon and a brief description. The features listed are: Medications, Journal, Calendar, Contacts, Notes, To-Dos, Photos and Files, Private, Secure Sharing, and News. The website header includes the CareZone logo, a tagline, and navigation links for Home, Features, Partners, About, and Sign Up.

member's, we'll help you stay organized and in sync.

Home Features Partners About Sign Up

- MEDICATIONS**  
Always have a list of medications, dosages, and schedules with you. Receive reminders, record doses taken, and track adherence progress over time.
- JOURNAL**  
Document symptoms for easy reference during medical appointments, record doctor's instructions, and privately share updates with family members.
- CALENDAR**  
Keep track of medical appointments, therapy sessions, and prescription refills. Sync events with other calendars, and share access with others, too.
- CONTACTS**  
Organize and share important contacts, numbers, and emails—including doctors, pharmacies, insurance providers, and the off-hours advice nurse.
- NOTES**  
Securely store insurance info, online account credentials, instructions, and other hard-to-remember details you might need in a pinch.
- TO-DOS**  
Keep a synchronized list of things you need to get done and stay organized on whatever device you're using. Assign tasks to others to get the help you need.
- PHOTOS AND FILES**  
Store discharge instructions, advance directives, and photos of important documents—like a driver's license—for easy access when you need them.
- PRIVATE, SECURE SHARING**  
Share access to important info with a spouse to make sure you have backup in case of an emergency, or family members to help coordinate care for a loved one.
- NEWS**  
Receive helpful, timely information and tips on health topics relevant to you and your family.

Figure D1: The Features available on the CareZone app. Courtesy of <https://CareZone.com/features>

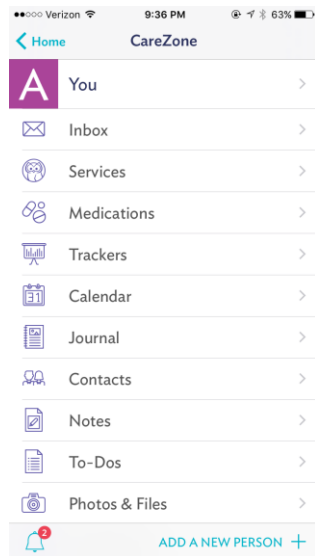


Figure D2: Screenshot of the CareZone app on the smartphone

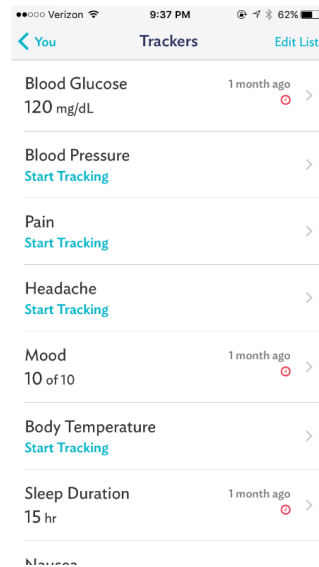


Figure D3: Screenshot of the tracker feature

## APPENDIX E: INTERVIEW GUIDE

Thank you for taking the time to be a part of this research study. My name is Annie Patrick. I am a graduate student at East Carolina University. I will be asking you a few questions.

You have been chosen because you have been identified as an individual that has an interest in technology and its benefits. My research is focused on you, a member of the baby boomer generation, and how the factors of ease of use and usability play a part in your use of smartphone apps for healthcare.

I will be recording our conversation today. Only the researchers involved in this study will have access to your comments and this discussion. This interview will last about an hour. During this time, I have several questions that would like to ask concerning your experience with the CareZone healthcare app.

Please keep in mind, that at any point you can stop the interview. You do not have to answer any questions that you do not wish to answer.

## Interview Questions

The CareZone app is a type of healthcare app for smartphones. The CareZone app is an example of the many type of healthcare related apps available for smartphone devices. The questions that I am going to ask you pertain to the usability and ease of use experience with app.

The following are general questions about your experience with the app.

### General Questions:

1. Please tell me about your experience with smartphone apps before this study?

### Probing Questions:

Have you used apps before?

Do you use most of the apps that you download?

How do you choose an app?

What factors influence your choice in an app?

Could you please tell me about any people that suggested that you use apps?

Are there any other factors (TV, work, etc) that influence your choice in app?

### Interviewer's Reflection:

2. What interested you in using a healthcare app for your smartphone?

### Probing Questions:

Did you know there were healthcare apps?

Were you interested in using healthcare apps before this study?

### Interviewer's Reflection:

The following are questions about the ease of use and usability of the app.

3. Could you please describe how the CareZone app. How did this app make your healthcare needs easier?

Interviewer's Reflection:

4. CareZone offers a lot of features, what did you like or not like about the features?

Interviewer's Reflection:

5. Could you please describe your experience downloading the app?

Interviewer's Reflection:

6. Could you please tell me about the features that were easy to use?

Interviewer's Reflection:

7. On the opposite end, could you describe any instances in which using the app made things more complicated or difficult?

Interviewer's Reflection:

8. How could this app have been more user friendly for you?

Interviewer's Reflection:

Future Use:

9. What would be the ideal healthcare app for you?

Interviewer's Reflection:

10. Would you be interesting in using similar types of apps on your smartphone in the future?

Interviewer's Reflection:

11. Would you recommend these types of apps to your peers?

Interviewer's Reflection:

Is there anything else you would like to tell me?

Overall how would you rate your experience?

Thank you for your time.

APPENDIX F: SURVEY

Initial Technology Survey

1. What is your age? \_\_\_\_\_ What year were you born? \_\_\_\_\_

Where do you currently reside? \_\_\_\_\_

2. What is the highest level of education you have completed?

Less than high school  High School Diploma  GED

Trade/Technical School  Community College  Four- Year University/College

Bachelor's Degree

Graduate Degree  Professional Degree

3. What is your current work status?

Full time  Part Time

Retired  Retired/Part-time  Other: \_\_\_\_\_ -

4. What is your occupation/what was your occupation when you were in the workforce?

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5. I own a smartphone. Yes  No

6. I use my smartphone to access the Internet. Yes  No

7. I use my smartphone to access the Internet on average:

Once a day  A few times a day  A few times a week  Once a week  Rarely  Never

8. I use apps for smartphones. Yes  No

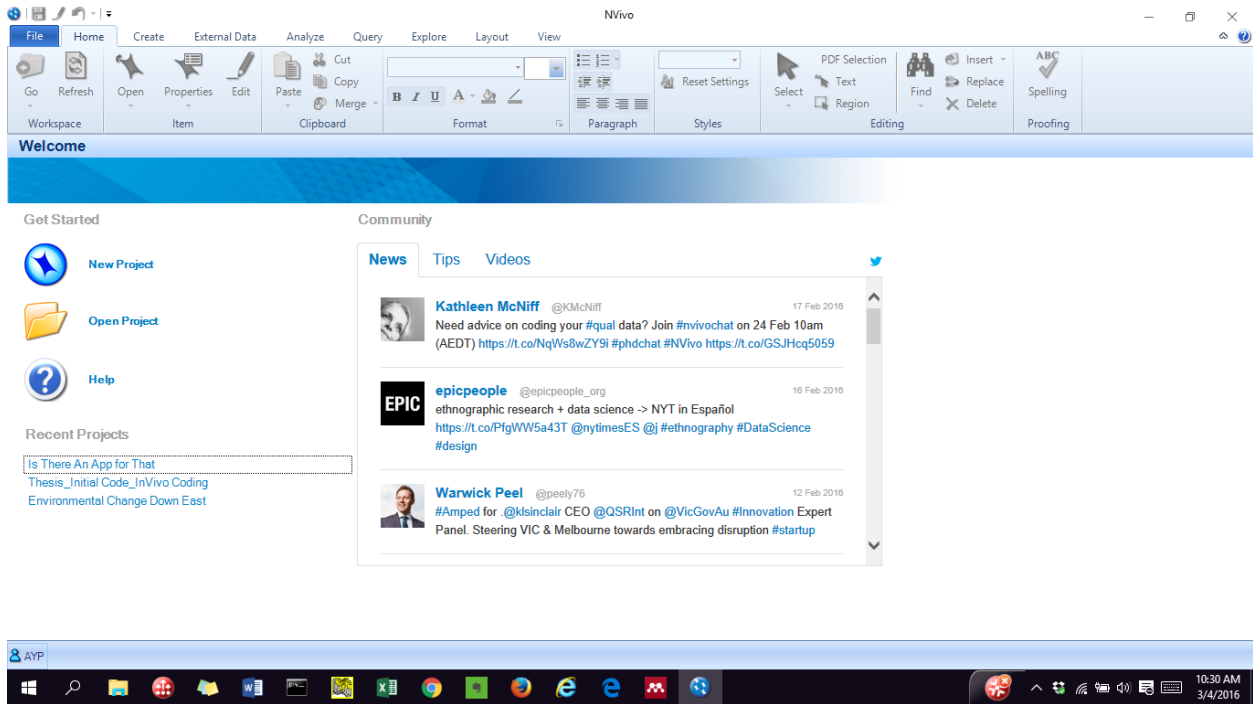
9. I use smartphone apps on average:

Once a day  A few times a day  A few times a week  Once a week  Rarely  Never

10. Would you be willing to use a smartphone app for healthcare? Yes  No



# APPENDIX G: NVIVO SCREENSHOT



## APPENDIX H: FIRST CYCLE CODE LIST

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| Code Name   |
|---|
| App Download Experience - Neutral                   |
| App Download Experience- Difficult                  |
| App Download Experience- Easy                       |
| App Selection Influences                            |
| CareZone - Ease of Use                              |
| CareZone App Ease of Use - Negatives                |
| CareZone Features-Applicable                        |
| CareZone Features-Disliked                          |
| CareZone Features-Liked                             |
| CareZone Features-Neutral                           |
| CareZone Healthcare app recommendations for changes |
| Ease of Use   |
| Feelings toward technology                          |
| Healthcare App Exposure                             |
| Healthcare app for future use                       |
| Healthcare lifestyle changes - Positive             |
| Healthcare Lifestyle Changes- Negatives             |
| Helpful   |
| Ideal Healthcare App                                |
| Misc.   |
| Negatives-Cons of Apps                              |
| Non Smartphone App Healthcare Technology            |
| Parents   |
| Positives-Pros of Apps                              |
| Recommend Healthcare App-No                         |
| Recommend Healthcare App--yes                       |
| Smartphone App descriptor word-functionality        |
| Smartphone App Descriptor Word-Redundancy           |
| Smartphone App Experience - Efficiency              |
| Smartphone App Experience - High Use                |
| Smartphone App Experience--Minimal Use              |
| Smartphone App Words                                |
| Technology Experience Usage                         |
| Types of Apps used                                  |
| Usefulness  |

---

APPENDIX I: MEMBER CHECK

| Participant Number | Participant Comments to Transcripts   | Participant Comments to Results  |
|--------------------|---|--|
| Participant 1      | I agree.  | Agree. No Comments   |
| Participant 2      | It looks great.   | Agree. No Comments   |
| Participant 3      | I agree. Looks accurate. Thank you  | Agree with findings.   |
| Participant 4      | I approve/ agree with the provided transcript.  | No Discrepancies. Agree with Findings  |
| Participant 5      | Looks fine. I agree   | I agree with the results. I enjoyed talking with you and the app was easy to use   |
| Participant 6      | You did a great. Hope you got everything you needed for your research.  | Great job. Very thorough and very informative.   |
| Participant 7      | I agree with the interview  | Agree. No commentst  |
| Participant 8      | Looks fine to me. I agree with the transcription of the interview.  | I especially like your findings about maintaining independence. I think that's so important to people as they grow older. Having medical resources available at your fingertips, is empowering. Thank you for allowing me to participate in this study         |
| Participant 9      | Looks good to me, I agree with it.  | Looks good, great job. The apps I use daily are. Bible gateway, email, battery doc,facebook. Weekly Yahoo, weather channel, maps sleepytime, iheart radio. I have almost 150 apps. Used for convenience and making tasks easier. I have found all easy to use. |
| Participant 10     | The script represents what I recall from our recent interview. Thank you for your help in calming down for this experience. Should you require my assistance in the future please advise. | The information of the interview is quite as I recall it. It is also very helpful to me in planning to utilize apps for better health coordination going forward.  |

APPENDIX J: FIRST CYCLE INTER-RATER RELIABILITY

| Interview Number    | Coder 1       | Coder 2       | Percentage |
|---------------------|---------------|---------------|------------|
| Interview 1         | 17 Nodes      | 12 Nodes      | 70.6 %     |
|                     | 23 References | 18 References | 78.3%      |
| Interview 2         | 15 Nodes      | 17 Nodes      | 88.2%      |
|                     | 42 References | 31 References | 73.8%      |
| Interview 3         | 19 Nodes      | 22 Nodes      | 86.4 %     |
|                     | 28 References | 43 References | 65.1 %     |
| Interview 4         | 18 Nodes      | 21 Nodes      | 85.7%      |
|                     | 29 References | 25 References | 72%        |
| Interview 5         | 13 Nodes      | 14 Nodes      | 92.9%      |
|                     | 18 References | 25 References | 72%        |
| Interview 6         | 19 Nodes      | 16 Nodes      | 84.2%      |
|                     | 32 References | 30 References | 93.8 %     |
| Interview 7         | 12 Nodes      | 15 Nodes      | 80%        |
|                     | 28 References | 27 References | 96.4%      |
| Interview 8         | 13 Nodes      | 12 Nodes      | 92.3%      |
|                     | 17 References | 23 References | 73.9%      |
| Interview 9         | 13 Nodes      | 13 Nodes      | 100%       |
|                     | 20 References | 22 References | 90.9%      |
| Interview 10        | 15 Nodes      | 17 Nodes      | 88.2%      |
|                     | 35 References | 37 References | 94.6%      |
| Average Percentage: |               | Nodes         | 86.9%      |
|                     |               | References    | 81.1 %     |

## APPENDIX K: AXIAL CODE INTERVIEW RESPONSES

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### Communication

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Basically by word of mouth

From other people that have used the app before or introduced themselves to the app

More word of mouth.

Someone told me about an app that was free and that it was easy to use, that kind of thing.

I would say family members, adopted family members, and just reading here about it.

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### Help/assistance

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A lot of times I still may go to Rebecca to help me if I'm wondering am I doing something right or whatever.

Have someone to walk me through it

I think it's my age. I didn't grow up using computers and so, anything that's easier that I can ...

I don't have to sit and ask any of my children to do ... I feel like can figure out myself and it's that's what useful is to me. Easy to download, easy accessible

If it's necessary, then I'll have to bug somebody to help me, which gets old, too.

When it comes to apps, do you have family or friends that help you with these apps,

downloading them~~~Speaker 2~~Yes, I'm trying to become more independent of them, but if I have difficulty, I have nieces and nephews who can walk an old man through it.

You have your daughter who's helping you with some of the apps, and then you also have apps that are from him

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### Independence

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Am I going to have to try to get somebody to help me~~

I think it's my age. I didn't grow up using computers and so, anything that's easier that I can ...

I don't have to sit and ask any of my children to do ... I feel like can figure out myself and it's that's what useful is to me. Easy to download, easy

What I can't get out of the book, then I have to ask for help. I'm not that crazy about asking for help

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### Learning Behavior

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I'm just in that age

After you get basic knowledge then you can experiment

And what I rather do is go to the book,

But I do believe it has the capability to do that, it's just I haven't gained the knowledge and expertise to do it

But this is not the only app that I wish had something like that.~~Annie~~So overall, you wish more apps had tutorials or something~~~Speaker 2~~Yes

But we learn in different ways

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Could this app be more user friendly~~~Speaker 2~~Yes. ~~Annie~~How so~~~Speaker 2~~By having a user manual, You Tube video,  
For me, give me something in writing  
having a frame work from which to operate, that's one of our many shortcomings  
How would you define clear~ ~~Interview 10~~I understood what they were directing me to do  
I could do a search, and it would be the Care Zone user manual. I can download it.  
I could download the user manual.  
I download it and I have a problem, I could print out whatever that part is about  
I envision doing a search and the You Tube thing will tell you how to set it up, and how to go through this particular feature, etc. That kind of thing.  
I know that everybody says, ~Oh, there's an app for that,~ but I just tend to not think that way. I think it's my age. I didn't grow up using computers and so, anything that's easier that I can ... I don't have to sit and ask any of my children to do ... I feel like can figure out myself and it's that's what useful is to me. Easy to download, easy accessible  
I would say not more than 10 minutes, but if it has the ability to do only You Tube like you can with the paper version you could go to that part that you needed, that would be helpful, I would wear that rascal out.  
I'm good with words and pen and paper and that kind of thing,  
I'm not sure if that's a function of the app or a function of ~Interview 8~ not functioning well in the morning. When I slow down, obviously they're there.  
I'm still, as I said earlier, still in the process of trying to understand the end result of using it.  
I'm in the process right now  
I've tried and read and try to master that which is in writing,  
My guess is I haven't figured out how to make that happen with this app.  
now that you have to a lot of times have more than the basic knowledge to work something or remember things, which I don't do so well now  
Now, for younger folks, that seems to be something they're intuitive to know,  
Okay, it would also be nice to have that little wonderful thing on You Tube on how to go through it.  
Once I figured out the technique it worked well.  
People of my generation, we want to know before we do, and we're not into the habit of learning while you do.  
Print it out, that's it. Finding the user manual, I didn't get that.  
That is where I learn more.  
The log-on thing because that just gets me annoyed right from the beginning. It seems to be really straightforward.  
The one that I like the most but I still find frustration actually using it because I'm afraid I'm going to do something wrong  
There are apps that are a little bit more difficult to use that I don't use.  
There are instructions on how to use it.  
To do this, some people are kind of forgetful, so~~~Speaker 1~~Okay.~~Speaker 2~~-it's good to put their thoughts in~~~Speaker 1~~Okay.~~Speaker 2~~-before they forget them.  
Trying to figure out how in the world to use the dog gone thing  
Wasn't quite sure how easy or how involved that might be, and I just didn't do it.  
We are the buyers' market for that, and we do need help with that.

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What I can't get out of the book, then I have to ask for help. I'm not that crazy about asking for help

When I grew up, you didn't really have phones like they have now. The generation that really adopted the phone, you see them on it a lot more than somebody in my particular age range. I don't really call myself a phone person

You have your daughter who's helping you with some of the apps, and then you also have apps that are from him

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#### Need or Purpose

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I don't really go and download a lot of apps because I don't use a lot of apps.

By and large about four of them I use regularly, at least once a day. The others I might as needed, not quite as frequently as that.

definitely be very helpful if, like my husband said, if you had health issues that, thank God, right now we don't

Did that peak your interest more in those types of apps, like healthcare apps~~~Speaker 2~~~Absolutely. That and my father. ~~Speaker 1~~Great, thank you. ~~Speaker 2~~My aging father.

How are the apps affecting your life when you use them~ ~~Interview9~~I would say they make it easier. They help me to continue ... I guess some apps you realize you don't need them until you get them, and then you realize how handy they are. They help me

How would you define easier~ ~~Interview9~~Well, like I said, especially with the fuel ... My motorcycle requires a special fuel, and the app that I use is very handy. I can either pull up a map or pull up a city, and it'll show me in that city

how would you define helpful for you~~~Speaker 2~~~I'd say anything that I require to meet my current needs for the day, that might make my life a little easy

I am thinking that the people who would need this app most are folks in my age group.

I guess I have been blessed with good health and it has not been something that has been on my radar.

I had a need, a health need, it would cause me to certainly explore other apps.

I need to balance my checkbook all the time, just keep a daily total of what I have in the bank, or for getting from one place to the other, especially with the maps. I love the map, the Google maps. I think, just living, it's easier living.

I think we also talked about that, how nice it would be to have an app that you could go to, have that information just at your fingertips versus paperwork that gets lost and that sort of thing.

I understand healthcare, I understand the need for the information, how important it is to have your information on an app.

I wouldn't say I really need an app since I'm blessed with good health. I would have to say, right now, nothing. I don't really need one at this point.

Influences your choices in these apps~~~Speaker 2~~~Frequency of need. I think that's probably ... The frequency of need for me. I think for me, when I use an app, it's something that I'm going to probably use every day

It gives me ready access at my fingertips about the status of those accounts anytime I need it or want it.

It has to have a good function, a purpose

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It helps me become more organized

It makes life for me, simpler, more efficient, because I'm not wasting time doing other things

It was not so much for myself, it was really for my father, like an aging parent, to have that information for myself

It's a source of information. It's an extension of my knowledge in that if I need information about a certain issue, I can Google and other resources, I can go in and get the information instantly without spending a whole lot of time.

It's hard to justify having much on there if I'm not going to use it enough to justify that.

I've come to use quite a number of smart phone apps because they assist me in research in a couple of things that I do, research is absolutely essential

Not just for the fun of it

Not really. Again, we go back to the fact that thankfully, we don't really have any needs right now

One that can help me identify the immediate responses to the questions that I'm looking for more directly. Not having to spend additional time talking with someone or doing extra research, more directly I can access information that would be useful.

Other apps quite often just to stay informed and conduct life everyday

Out of need and doing a search

Right now lowering my Medicare copay's does not really apply to me, so that is probably, that is a good thing. I would say that would be the one that I would not use as far as services.

Roan's put on so that he can play games. Bec found one that actually is pretty good if you're traveling and need to do a workout without ... You don't have accouterments to do it with. You can just usually do most everything on there in your room, so that

Sometimes I will go searching for apps based on the needs that I have.

The medications are awesome because at one time I was carrying around a piece of paper to let my care providers know what medications I was on. With this, look it up and show it to them and they can copy it and save me some time

There has to be something I need

There's an app I use because I run a particular type of gas in my motorcycle, so that app helps me find those stations. I use that one on a regular basis

Until that need occurs, I probably will not use it much.

Was it useful to you? ~ Interview 9 ~ Since I don't regularly go to the doctor and I'm not on medication, I would say it's not really useful at this point, but in the future it would be very helpful.

Were there anything in the app that make things more complicated or difficult? ~ Speaker 2 ~ Not that I know of, no.

What influenced you to go to a smartphone? ~ Interview 9 ~ With my work, and a lot of the stuff I was doing with work, it was a lot easier to ... Like I said, I was doing a lot of traveling, and finding businesses, and being on the road.

With my job, probably 2 or 3 times a week I'm on the road, so I use apps with the GPS, and stuff like that.

Yeah. I think that if I took a lot more medicine ~ Speaker 1 ~ Mm-hmm (affirmative). ~ Speaker 2 ~ it would really help a lot.

You mentioned that you use apps for organization, would you say that they help you become more organized, and they help you in that matter? ~ Speaker 2 ~ Yes, undoubtedly.

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## Relationships

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A brother who's a fanatic with Apple products and the apps

A lot of times either a friend, or I'll see watching on TV or on the Internet something, and it'll be talking about a particular app. Most of the time I'll say, ~Yeah, that works fine. I'll try it out.

A relative told me about it.

Actually it would be a wide range because some of them are even my daughter's ages basically by word of mouth

Bec found one that actually is pretty good

Friends and family. Family's a big one

Friends point me to a certain app

From other people that have used the app before or introduced themselves to the app

I would say mostly from friends, always

I'm always asking persons that I know which ones that they use most of all and what's helpful to them.

Many of them are baby boomers.

Most of them, I would say, would be recommendations, that is still the best advertising despite our digital age

Or maybe my husband.

recommendation from a friend

Roan's put on so that he can play games.

Someone told me about an app that was free and that it was easy to use, that kind of thing.

Sons trying to keep me up to date on things.

Usually, it's just somebody's told me, like my children

When you mentioned friends, are these friends more in your age range peer group, or ...

~~Interview9~~Some in my age. Some of them are dealing with people I work with, so that's a multi-age. Yeah, I would say different ages

You ask a lot of baby boomers about which apps to use and stuff~~~Interview 10~~Yes.

You have your daughter who's helping you with some of the apps, and then you also have apps that are from him

You mentioned word of mouth. Is this from your peers, family, work~~~Speaker 2~~I would say family members, adopted family members, and just reading here about it.

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