ANTICIPATED TELEHEALTH DEVICE USAGE IN YOUNGER ADULTS

by

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ABSTRACT

Telehealth and telemedicine have revolutionized the healthcare system in terms of access to information and remote medical treatment. While there is a great deal of literature on *current* perceptions of telehealth care systems, relatively little is known about perceived user needs and acceptance of *future* telehealth systems. One way to assess future attitudes is to evaluate anticipated usage of telehealth devices through perceived advantages and disadvantages. Additionally, this study seeks to assess the reliability of a new measure of technology acceptance that capitalizes on human motivation using self-determination theory. An online survey consisted of an original 40-item measure of motivation to use telehealth technology, the Psychosocial Impact of Assistive Devices Scale (PIADS; Jutai & Day, 1996), questions adapted from Edwards et al. (2014) about perceived advantages and disadvantages of telehealth devices, and open-ended questions about advantages, disadvantages, and concerns of interacting with telehealth devices in the future. The open-ended questions were coded for themes. Results also indicated that there was a high reliability between the MUTT and the PIADS, however the MUTT was slightly more reliable. Significant correlations were found between the overall MUTT and subscales of autonomy, competence, relatedness, and goals, as well as moderate correlations between the subscales of the PIADS (i.e., competence, adaptability, self-esteem) and the MUTT. The results of this research will be discussed further.

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INTRODUCTION

Within the last decade, the fields of telehealth and telemedicine have revolutionized how healthcare is delivered and accessed (Malvey & Slovensky, 2014). A telehealth system is defined as a technology that supports the administration of healthcare services to any location. Telehealth facilitates the exchange of health information, patient engagement, and healthcare services delivery, including diagnosis through the use of electronic, digital video and/or audio streaming, mobile devices, email and other telecommunications, allowing patients to virtually interact with healthcare providers for the purposes of "monitoring, maintaining, and improving health status" (Malvey & Slovensky, 2014). In a similar vein, Benavides-Vaello, Strode, and Sheeran (2013) define telehealth systems as "healthcare, health information and health education across a distance through the use of telecommunication technology and specially adapted equipment."

Telehealth systems were originally developed in a response to limited healthcare and mental healthcare facilities in rural and underserved populations (Benavides-Vaello et al., 2013). Recent studies indicate that telehealth systems are important for delivering healthcare to multiple populations, especially those with chronic illnesses such as diabetes (Afshar et al., 2014; Pagan, Chen, & Kalish, 2011; Arsand et al., 2012), cardiovascular disease (Edwards et al., 2014; Merriel, Andrews, & Salisbury, 2014), pain (Dear et al., 2013), and mental health issues (Backhaus et al., 2012; Buckley & Weisser, 2012). Telehealth systems have also been successful in reducing the number of hospital readmissions due to predictable situations such as poor communication across the patient

care continuum, poor planning prior to patient discharge from the hospital, and lack of understanding by the patient or family members involved (Force & Brandy, 2013). Typically, telehealth systems are praised for reducing time and travel costs, as well as for their convenience. Interestingly, some telehealth devices have been found eliminate the "white coat" phenomenon, in which the mere presence of a medical professional induces higher anxiety levels that result in elevated measures of blood pressure or pulse (Malvey & Slovensky, 2014). Additionally, in some circumstances telehealth facilitates trust, such that patients actually disclose more information to medical and mental health professionals when online under the guise of anonymity (Suler, 2004). Biscoff (2004) argued that anonymity in telehealth in the provision of mental healthcare could allow portions of special populations to seek treatment that otherwise would not. The effects of telehealth systems are thus widespread and telehealth has demonstrated advantages for treating physical diseases and psychological disorders.

While there are many benefits related to telehealth systems, there are also many barriers preventing adoption and use of these technoogies. One barrier of particular importance is the affordability because of lack of reimbursement (Malvey & Slovensky, 2014). Medicare/Medicaid does not currently cover the cost of telehealth, although some states are beginning to cover some types of telehealth services and providers. However, this reimbursement is variable. Furthermore, there remain several legal issues surrounding the implementation and operation of telehealth systems. Legal issues involving telehealth services that are delivered across state lines, as well as unresolved security and privacy concerns interfere with telehealth adoption (Malvey & Slovensky, 2014).

Background

To date, only two studies have investigated factors that influence anticipated usage of telehealth services (Edwards et al., 2014; Axelsson, Naslund, & Wikman, 2013). In one study, a cross-sectional postal survey was conducted using patients from general practices in two different regions of England (Edwards et al., 2014). The telehealth survey targeted patients with depression and those with increased risk of cardiovascular disease (CVD; Edwards et al., 2014). They reported that 60 percent of patients with chronic illnesses were interested in using phone-based telehealth and 57 percent were interested in using internet-based telehealth services. The study analyzed several relevant factors: socio-demographics, health concerns, difficulties accessing healthcare, technology-related factors, confidence, satisfaction, perceived advantages, and perceived disadvantages of telehealth devices (Edwards et al., 2014). The authors reported that confidence in using the technology and perceiving more advantages than disadvantages were the strongest predictior of telehealth adoption and application usage.

In another study, the anticipated psychosocial impact of current e-health programs and of future mobile health applications was evaluated in Swedish sample of older adults, (Axelsson et al., 2013). In this study, a postal survey was sent to participants, who were asked to respond to hypothetical scenarios (depicted by cartoon drawings) of e-health services. The participants rated each scenario using the Psychosocial Impact of Assistive Devices Scale (PIADS; see Day & Jutai, 1996; Jutai, 1999; Day, Jutai, & Campbell, 2002), a measure of perceived impact. Axelsson et al. (2013) found that participants anticipated positive psychosocial impacts for the current web-based e-health and future mobile health

applications. Additionally, individual differences such as gender and internet usage were correlated with the anticipated usage.

Self-Determination Theory

Self-determination theory (SDT) proposes that autonomy, competence, and relatedness facilitate human motivation and health-related behaviors (Ryan & Deci, 2000, Ryan & Deci, 2001; Ryan & Deci, 2008). Ryan, Patrick, Deci, and Williams (2008) suggest that motivation and patient experience are important in sustaining health behaviors over time. Similarly, Andersson and Cuijpers (2009) evaluated relatedness in a social support and peer support context. They found that peer support available via telehealth devices can improve the effectiveness of internet-based psychological treatments. In another example, McTavish, Chih, Shah, & Gustafson (2012) used SDT to develop a smartphone-based system, called A-CHESS, which was "designed to improve competence, social relatedness, and motivation" in patients with alcohol addiction. Results indicated that 70 percent of patients who received the smartphone with A-CHESS after residential treatment were still using the application 16 weeks later (McTavish et al., 2012). Note that participants who used the theory-driven telehealth application exhibited wsustained engagement in positive health outcomes at a higher level than the control group. However, the authors did not assess the motivation to use telehealth system a priori, nor did they explore motivational differences between the two experimental groups.

Sieverdes et al. (2013) applied SDT in the development of a mobile program for self-management of health medication and blood pressure self-management. The program

involved the use of medication trays, connected to patients' cellular phones, to remind patients to take their medication (Sieverdes et al., 2013). The telehealth program also used smartphone messaging to remind patients to take blood pressure readings at home using a monitor with Bluetooth capabilities (Sieverdes et al., 2013). The authors argued the program was successful because its design was based on principles of SDT and autonomous regulation. In future studies, Sieverdes et al. (2013) also suggested than an important next step would be to develop a valid and reliable self-report measure of motivation to use telehealth.

The Present Study

Self-determination theory (SDT) has often been applied to improving healthcare and helping others adhere to healthy behaviors (Ryan, Patrick, Deci, & Williams, 2008), yet it has not been widely applied to telehealth system design (only two studies were found in this literature search) and redesign.

Moreover, no researchers have approached the measurement of motivation to use telehealth technology from a theoretical perspective, especially not from the SDT standpoint.

The primary goal in the present study was to validate a new measure of motivation to use technology using the three fundamental psychological needs described in self-determination theory: autonomy, competence, and relatedness. The present study attempts to better predict telehealth device usage by testing a new measure specifically designed to

assess motivation for using mobile health devices relative to an atheoretical measure of human motivation (Axelsson et al., 2013; Day & Jutai, 1996; Edwards et al., 2014).

The Role of Aging in Device Usage

Younger adults comprise a much smaller portion of the healthcare system and some of the technological barriers for older adults do not apply to younger adult populations. However, the younger adult population may constitute a smaller portion of the healthcare system, but chronic diseases do occur in this population, including diabetes, cancer, depression, substance dependence and various mental health issues. It is therefore important that this population be represented in the telehealth research. Thus, all the more reason to explore anticipated motivation to use technology for telehealth purposes. Lastly, certain motivational characteristics might correlate or predict anticipated telehealth engagement, which is important to assess in a student population.

Telehealth Device or mHealth

The telehealth literature uses several terms that seem to imply the same or similar concepts in terms of devices that facilitate telehealth. Malvey and Slovensky (2014) define mobile health or mHealth as the use of devices including smartphones and tablets in the practice of medicine. However, several other articles in the telehealth literature use the term "telehealth devices," and seem to apply to any devices used to facilitate telehealth or telemedicine. For purposes of this paper, the term "telehealth devices" will be used to encompass smartphones, tablets, computers, and several other devices that may facilitate

telehealth, but are not necessarily mobile. It should be interpreted to those who are more familiar with the term mHealth or mobile health as essentially the same concept.

METHOD

Participants

Two hundred and thirty-three undergraduate students (80 males; 142 females; and 1 transgender) between the ages of 18-34 (MAGE = 19.99 years, Median = 19.00 years, SD = 2.77 years) participated in this study. Any participant over 35 years of age was not included in the results. Additionally, participants who did not complete every measure (i.e., PIADS or MUTT, behavioral inventory, etc.) were excluded. Participants were recruited from the psychology research participation system (e.g., SONA) at the University of Central Florida. Participants were awarded credit for their undergraduate courses. All participation was voluntary and no other form of compensation was used in this study.

Measures

Demographics

General demographics asked participants about their gender, age, nationality, ethnicity, etc.. Demographics were administered at the end of the survey to reduce stereotype threat or gender bias in terms of health and wellness.

Behavioral Inventory

Behavioral items or questions examined several behavioral tendencies of individuals. For example, technology usage questions, advantages, and disadvantages of telehealth devices, some of which were adapted from Edwards et al. (2014). Specifically, these advantage and disadvantage items were rated on a 5-point Likert scale with anchors from strongly disagree (1) to strongly agree (5).

Health Inventory

The health inventory queried participants about mental health concerns, chronic diseases, exercising habits, etc. Since this information is very sensitive, participants were reminded that they did not have to respond to these questions if they did not feel comfortable. Additionally, these items were administered at the end of the survey to reduce any bias or stereotype threat when filling out some of the healthcare-related items.

Psychosocial Impact of Assistive Devices Scale (PIADS)

The PIADS (Day& Jutai, 1996) is 26 -tem measure that is used to assess the psychosocial (personal and environmental) impacts of assistive devices or assistive technology. The measure can be used prior to interacting with assistive technology (anticipated impact) or after interacting with devices (experienced impact). The PIADS has been validated and demonstrates good predictive and construct validity, and high reliability. The PIADS exhibits three subscales which include competence, adaptability, and self-esteem. The competence subscale consists of items that relate to competence, productivity, usefulness, performance, and independence. The adaptability subscale includes questions on ability to participate, willingness to take chances, eagerness to try new things, and the ability to take advantage of opportunities. The self-esteem scale involves items that pertain to self-esteem, security, sense of power and control, and self-confidence. Each item is scored by participants on a Likert scale of 7 from -3 (maximum negative impact) to 0 (neutral impact) to +3 (maximum positive impact). Three items, one in the competence subscale and two in the self-esteem subscale, require reverse scoring.

The overall PIADS scores range from -78 to +78, while the subscales are calculated so that the range is from -3 to +3.

Motivation to Use Teleheath Technology (MUTT) Scale

The MUTT scale was adapted from an original scale that is currently being tested and validated within the Performance Research Laboratory. The MUTT was created as a reaction to the lack of motivational principles integrated in modern measures of human-technology interaction. This version of the MUTT was changed to the future tense and its scope widened to include general health care, as opposed to only mental health care, which is what the original measure assesses. Aside from these changes, the measures are the same. This 40-item measure is based in Self Determination Theory (SDT) constructs and is divided into four subscales that include autonomy (e.g., "I would feel like I have many choices for seeking healthcare."), competence (e.g., "I would feel more knowledgeable about my health concern."), relatedness (e.g., "I could better connect with my healthcare provide"), and goals (e.g., "I could visualize my progress."). The scale is administered on a Likert type scale of 5 from "strongly disagree" (1) to "strongly agree" (5). Question order in the scale was randomized across participants to control for order effects, which is in line with measurement testing. Scores on the MUTT scale range from 40 to 200 overall and from 10 to 50 on each of the subscales. Higher scores on MUTT indicate more motivation to interact and engage with a telehealth device, whereas lower score indicate less motivation to engage with telehealth devices based on competence, relatedness, autonomy, and goals.

Procedure

This study was administered using the Qualtrics survey system. After reviewing the informed consent, participants were first given a definition of telehealth that read:

> *"Telehealth is the exchange of medical information from one party to another via electronic communication. It is used to monitor, maintain, and improve a patient's clinical health and mental health status. Telehealth includes using two-way streaming video, email, smart phones, smart watches, wireless tools, or other forms of electronic telecommunications to interact with a medical professional."*

Participants were reminded to bear this definition in mind when completing the survey and were asked to reread the definition before answering questions on the second measure. The order of the administration of the PIADS and MUTT was counterbalanced across participants. Following completion of the measures participants were asked several questions regarding their technology use, health behaviors, a behavioral inventory, and their previous interactions with telehealth devices. Participants were then asked several open-ended questions about perceived advantages, disadvantages, and concerns related to interacting with telehealth devices. After responding to the open-ended items, participants were asked questions adapted from Edwards et al. (2014), which included items about the advantages and disadvantages of interacting with telehealth devices, however, participants responded to these statements on a Likert type rating scale of 1-5 (Strongly disagree – Strongly agree). The advantages and disadvantages adapted from Edwards et al. (2014) were asked after the open-ended questions so that participants would not bias their open-ended responses. The survey ended with health demographics and general demographics

(e.g., age, gender, etc.). This questionnaire was administered first in order to prevent priming effects resulting from reporting personal health information. At the conclusion of the online questionnaire, participants were provided a post- participation form and were redirected to the University Counseling and Wellness page.

RESULTS

Descriptives

One hundred and six participants were health-related majors and 117 were non-health majors. Additionally, 107 (48 percent) freshmen, 51 (23 percent) sophomores, 36 (16 percent) juniors, and 29 (13 percent) senior undergraduates participated in this survey, indicating skew towards very young adults.

The participants in this study reported substantial experience with technology: 189 (85 percent) participants reported owning at least one smartphone, 195 (87 percent) participants reported owning at least one computer, and 81 (36 percent) participants reported owning at least one tablet. For the most part, the student sample used in this study was relatively free of any physical or mental health problems. Only 34 (15 percent) participants reported a mental health concern in the last 12 months and 59 (26 percent) participants reported at least one health concern, which included chronic diseases and mental health concerns. It is important to note that most health concerns were chronic conditions with relatively low impact (e.g., asthma, allergies, etc.) and only 4 participants reported serious health concerns.

Differences in Motivation to Use Telehealth Technology

Table 1 shows the averages across all measures, as well as performance on the measure based on health concern and health/non-health majors. No significant differences were observed on the MUTT overall and PIADS overall or on any of the subscales based on health concern versus no health concern and health majors and non-health majors. The

high means for the MUTT scales indicate a high motivation to engage with telehealth technology in the future. The PIADS means, however, also indicate that younger adults anticipate a positive psychosocial impact from interacting with telehealth devices in the future.

Table 1: Average Scores and Standard Deviations on the MUTT and PIADS

	Overall *N* = 233		Non-Health Major *n* = 117		Health Major *n* = 106		No Health Concern *n* = 164		Health Concern *n* = 59	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
MUTT (overall)	153.46	21.97	153.46	21.97	156.44	20.91	154.86	21.86	155.47	20.33
MUTT Autonomy	38.26	6.03	38.26	6.03	39.44	5.36	38.84	5.73	39.00	5.68
MUTT Competence	38.43	5.86	38.43	5.86	39.77	5.99	39.05	6.02	39.39	5.81
MUTT Relatedness	37.46	6.27	37.46	6.27	37.49	6.26	37.55	6.38	37.27	5.94
MUTT Goals	39.30	5.77	39.30	5.77	39.73	5.48	39.42	5.75	39.81	5.21
PIADS (overall)	27.36	18.71	26.88	17.19	27.90	20.33	27.13	18.72	28.02	18.83
PIADS Competence	1.17	.78	1.13	.72	1.22	.84	1.14	.78	1.26	.77
PIADS Adaptability	1.16	.89	1.12	.82	1.20	.97	1.20	.87	1.03	.94
PIADS Self-Esteem	.79	.76	.81	.71	.77	.85	.78	.77	.84	.79

Reliability Analysis

Table 2 includes the Cronbach's alpha and intercorrelations for the MUTT composite and subscales, and the PIADS composite and subscales. Reliability was high for both the overall MUTT (a =.96), and for the overall PIADS (a =.92). The subscales of the MUTT and the subscales of the PIADS also showed relatively high reliability and were very similar,

with the exception of the PIADS self-esteem subscale, which only attained a lower reliability (a = .72), compared to the others (a > .85, in each case). There were statistically significant correlations between the two measures, within the subscales of each measure, and between the subscales of each measure. In addition, the magnitude of the correlations was generally substantial (see Table 2). MUTT subscales were highly correlated with one another and the PIADS subscales were moderately to highly correlated with one another. However, the MUTT and the PIADS were only moderately correlated (r = .568, p < .01). The subscales of the MUTT and the subscales of the PIADS were also moderately correlated with one another. The MUTT competence subscale correlated with the PIADS competence subscale (r = .545, p < .01) was shown to be the highest correlation between subscales of the MUTT and subscales of the PIADS.

Table 2: Reliability and Intercorrelations of the MUTT and the PIADS

	a	Intercorrelations (N=223)							
MUTT (overall)	.96	-							
MUTT Autonomy	.88	.917	-						
MUTT Competence	.88	.944	.828	-					
MUTT Relatedness	.87	.874	.700	.779	-				
MUTT Goals	.87	.912	.825	.832	.683	-			
PIADS (overall)	.92	.568	.533	.527	.518	.491	-		
PIADS Competence	.86	.572	.525	.545	.510	.503	.941	-	
PIADS Adaptability	.86	.481	.440	.430	.455	.425	.839	.695	-
PIADS Self-Esteem	.72	.483	.437	.396	.403	.358	.875	.733	.622

All correlations were Pearson correlations significant to the p < .01.

Advantage and Disadvantage Items

The items for the Edwards et al. (2014) advantage and disadvantage questions and the frequencies of responses are reported in Appendix A and Appendix B. In terms of the advantages, the frequencies showed that more than 70 percent of participants either agreed or strongly agreed, and less than 10 percent either disagreed or strongly disagreed with all of the advantage statements (with the exception of statements 1 and 4). While statements 1 and 4 still had a large amount of participants agree and strongly agree, these statements had more responses of "uncertainty" (these totals were nearly 30 percent). In terms of disadvantages questions, frequencies showed more variability in the responses. Statements 3, 5, 6, and 7 showed more than 60 percent of participants either agreed or strongly agreed, and only around 15 percent disagreed or strongly disagreed with the disadvantages. While Statement 2 still had 56.5 percent agree or strongly agree, the frequencies varied from statements 3, 5, 6, and 7 in that 26 percent of participants disagreed or strongly disagreed that they would not want to discuss sensitive issues over the phone. Statement 1, which concerned relying too much on technology, showed only 43.9 percent agree or strongly agree and 36.8 percent disagree or strongly disagree. Lastly, statement 4 which concerned potential anxiety about health from using telehealth services, actually had most participants (37.2 percent) disagree or strongly disagree to the disadvantage.

Qualitative Analyses

Open-ended questions were also asked to ascertain perceived advantages, disadvantages, and concerns of telehealth devices. These three qualitative questions were asked during the survey: whether participants perceived any advantages in interacting with telehealth devices in the future, whether participants perceived any disadvantages in interacting with telehealth devices in the future, or whether participants had any future concerns with interacting with telehealth devices. Two researchers, who separately noted repetitions and general themes in the responses, analyzed the responses of these three questions using the Framework Method for thematic analysis (Gale, Heath, Cameron, Rashid, & Redwood, 2013). The researchers then collaborated to create the defined themes and give appropriate examples of each theme.

Two different researchers who were not involved in the original construction of themes, and who have no knowledge of the telehealth literature, were given the themes and examples and asked to code all of the responses. The researchers were trained to code each response with as many themes that were representative of each individual statement. After coding the themes the primary researchers conducted an inter-rater analysis for each of the three open-ended response questions. Cohen's Kappa was found to be $k = .71$ for the advantages themes, $k = .85$ for the disadvantages themes, and $k = .80$ for the concerns themes. Differences in theme counts by the two researchers were averaged in each theme category to produce a number of times the theme was represented in the respective open-ended response.

The themes for advantages included convenience, health records, efficiency, provider connectedness, anonymity, and expense savings. Themes for disadvantages included privacy/security, human or device error, impersonality, cost, and self-diagnoses. Themes for future concerns included privacy/security, cost, human or device error, impersonality, overuse, accuracy, time, and efficiency.

Themes about Advantages

Convenience

This theme was identified 102 times and comprised 42 percent of the total coded themes of the advantage question. While many participants directly stated the term convenience as the advantage of interacting with telehealth devices in the future, however others implied examples including not having to live near healthcare provider, being able to stay at home for appointments, easy process, and saving time, including travel time.

Health Records

The theme of health records encompassed the concepts of better information of personal health concerns, gaining knowledge or understanding of current health status, monitoring progress of health, and overall better patient records available for healthcare providers. Participants stated this theme 50 times, making up 21 percent of the total coded themes.

Efficiency

Many participants found efficiency to be an advantage of interacting with telehealth devices in the future, with the theme being coded 45 times and comprising 19 percent of the total coded themes. While efficiency was often stated explicitly, issues of saving time in general were coded as convenience, whereas issues of quicker feedback were coded as efficiency. Efficiency was determined by faster feedback from healthcare provider or from results of health tests, as well as a more efficient process in general.

Provider Connectedness

This theme involved the concepts of having an increased connectedness with a doctor or healthcare provider, more access to a healthcare provider, and being able to have constant contact with the healthcare provider. The theme was coded for 28 times and comprised 12 percent of total coded themes. Many participants noted that it would allow for them to have a more active relationship with their provider, with one participant stating "this device might make it easier to build a relationship with the healthcare provider and to ultimately receive better care."

Anonymity

While this theme was coded relatively few times (six total), these statements were geared towards being able to talk about health issues more comfortably or without feeling embarrassed. It has been argued in the literature (Biscoff, 2004) that the feeling of anonymity as applied through telehealth and written communication, may result in

patients feeling more comfortable in expressing their health concerns. This theme implies that patients may expound on health issues because of a lack of face-to-face contact.

Expense Savings

The theme of being able to save money was coded only six times, but included explicit statements of reduced cost and the potential of paying less money because of reduced hospitalizations or visits to clinics.

Other

The "other" category only included seven responses, but there were some relatively thoughtful responses that did not necessarily fit with the other categories, including that there may be fewer errors or that it "could be helpful to most people," or show "improved clinical outcomes."

Themes about Disadvantages

Privacy and Security

This potential disadvantage theme was highly reported amongst participants with it being coded 78 times and comprising 38 percent of the total coded theme. Issues of privacy and security included the potential hacking or leaking of private health information and whether the devices could reliably store health information. Many participants noted that they would not want their health information to be "given to the wrong person."

Impersonal

Many participants reported that potential disadvantages of the telehealth devices would be a lack of face-face-contact, which may be necessary for treatment or diagnoses, not feeling connected to the healthcare provider, or potentially interacting with non-doctors. The theme was coded 56 times and comprised 28 percent of the total coded themes.

Error: Human or Device

The potential of error, whether it be technical from the device, or human error were reported 42 times and made up 21 percent of the coded themes. Many participants believed that there would be potential disadvantages in the telehealth devices not working properly, or incorrectly recording health information, but participants also reported potential issues of them not knowing how to use the device properly, misreading of information, or having usability issues.

Cost

While the disadvantage of cost was only coded 10 times, several important statements related to cost seemed relevant, including a potentially costly device, as well as the cost to interact with provider or receive feedback. This theme is highly relevant in the literature and seems to be one of the largest issues for adoption of telehealth.

Self-Diagnose

This theme was only coded six times, but the statements were particularly powerful with some participants stating that it would cause them to "overanalyze health issues" or

"get carried away and think they have all types of issues/diseases." While self-diagnosing has some relevant advantages such as the convenience of diagnoses from home and the avoidance of other sick patients (Malvey and Slovensky, 2014), the participants in this study focused on this theme as a disadvantage because it may cause them to falsely conceive health issues.

Other

In the disadvantage responses, the "other" theme resulted in a total of eleven responses that did not fit well in any of the other categories. One participant noted that the experience "could be scary." Other participants saw potential disadvantages in patients reporting false information, "increased dependence on the healthcare provider," that doctors would "know when you are not following the plan and being lazy," that some people may be upset from seeing results not improve, or that "not everyone likes technology."

Themes about Concerns

Participants showed some concerns about interacting with telehealth devices in the future. For example, participants may find a disadvantage of telehealth devices to be that they lack the ability to diagnose certain diseases that require personal contact, which also overlaps with concerns. However, participants may be *concerned* with potential expenses that are required to pay for telehealth devices, and less concerned with certain perceived disadvantages. This question allowed for a better understanding of what might prevent younger adults from interacting with telehealth devices in the future.

Privacy/Security

Much like in the disadvantages section, privacy and security themes recurred the most in terms of concerns. There were some differences in types of responses in that participants noted that they would be concerned if there was no password protection or if there was not a secure network/database. While the majority of responses were about potential hacking or leaking of health information, this section expanded upon some of the previous implications involving security and privacy.

Cost

The theme of cost was reported much more as a concern of interacting with telehealth devices than as a disadvantage with the theme being coded 32 times as opposed to 10, and making up 14 percent of total coded themes. Many participants noted that they would be concerned if the cost of interacting with the device was too expensive, or if it would be covered by insurance. Some participants even noted that cost would be a "limiting factor" of whether they would use a telehealth device in the future at all.

Error: Human or Device

Concerns of potential device or human error were reported much less times than the same theme as a perceived disadvantage with 22 coded responses and only 10 percent of the total themes. While many participants still reported system errors of the device not functioning or working properly and human error of not using the device correctly, responses showed a new variation of not understanding how to use the device properly.

Impersonal

The theme of being concerned with interacting with telehealth devices in the future because of the device being impersonal, lacking face-to-face contact, or not feeling connected to healthcare providers was of less importance than the same theme as a disadvantage. Only 17 participants stated this theme in their responses comprising seven percent, which may be in part because a new theme of accuracy was found in the qualitative responses.

Accuracy

The theme of accuracy was coded as a new theme because participants specifically noted that they would have concerns of accuracy of their diagnoses over the telehealth devices specifically in terms of how some diseases simply could not be discovered without live interaction. Additionally, participants reported concerns of reliability of diagnoses through a device that was not used in a provider setting. Accuracy themes were coded 17 times, and made of seven percent of total coded themes.

Overuse

The overuse of device theme mimicked some statements that were found in the other category in disadvantages as well as the self-diagnose theme. The theme was coded 15 times (seven percent of total coded themes) and comprised concerns of reliance on the device, the device becoming a necessity, and a dependence on technology, as well as the potentially using the device when it is not necessary, or overusing devices so that they overload the healthcare providers.

Time

Concerns of time were only coded nine times, but included issues of the device being an inconvenience such as requiring an extensive time commitment of actually using the technology or through the device requiring extensive time to learn how to use or time taken away from daily activities. This theme may show implications that time commitment needs to be relatively low for the device to be used.

Efficiency

Participants noted, though only five times, concerns of healthcare providers not providing efficient and prompt feedback, or whether the device is actually more efficient than not using the device. While the theme was coded relatively few times, it shows that, what should be an advantage could be a concern if the device is not implemented properly.

Other

The other category was coded the most times as a concern with fourteen coded responses. Some responses provided great insights to potential concerns such as that participants would use the devices for "getting in shape," but not for serious issues, and whether the participant would actually sustain usage. Some other concerns included how user friendly the device would be or whether the device was "bulky and unattractive."

DISCUSSION

Telehealth has the potential for completely revolutionizing the healthcare system and with the pervasiveness of computers, tablets, smartphones and eventually smart watches, people now have more control over their personal data and 'quantified self.' This study was important because it assessed anticipated usage in younger adults who are arguably some of the most technologically engaged adults in the United States. While it is certainly important to include special populations, such as older adults who make up the majority of the healthcare it is equally as important to examine healthy populations of younger adults, as disease can have an unknown onset. It could be argued that healthy younger populations play the smallest role in healthcare, however in terms of technology acceptance and usability, they may have the fewest barriers. It could also be argued that rural and underserved populations have the most to gain from the use of telehealth systems, but that should not imply that those in suburban or urban settings cannot benefit from telehealth services and its potential advantages. One important goal of this study was to assess human motivation to use telehealth devices in the future. As noted previously, motivation plays an important role of sustaining health behaviors over time, thus the assessment of anticipated motivation to use telehealth technology is of great importance. Again, there were no significant differences between those with health conditions and those without health conditions, as well as health majors and non-health majors. The lack of significant differences between these groups is in fact helpful in future tests of the MUTT and PIADS. The lack of differences between these groups means that the measures can be compared equivalently. The means on the PIADS measure indicate that there is an

anticipated positive psychosocial impact of telehealth device usage in younger adults. While confirmatory factor analyses were not conducted in this study, future tests on the MUTT will assess the predictive power of the measure and examine the role of motivation in device usage. That said, this study was able to compare the reliability of the MUTT and PIADS, which show promise in terms of their reliability in assessing motivation. This is important because many measures gloss over the spectrum of human motivation or measures of motivation to use technology and neglect the various needs of individuals when they interact with technological devices (Szalma, 2014). One prominent theory that should be integrated into the assessment of telehealth devices is SDT (McTavish et al., 2012; Sieverdes et al., 2013; Szalma, 2014). This theory was selected for motivation because it has been applied to other similar areas of research with great success, but not as well into human factors, until recently (Szalma, 2014). The MUTT was developed using SDT as a framework for these reasons.

In terms of recurrent themes of the advantages to using telehealth systems in the future, it is not surprising that most participants noted an increased efficiency and convenience as perceived benefits of telehealth systems. The frequency data based on Edwards et al. (2014), further affirm that issues of convenience, such as not having to travel to appointments, being able to stay at home to gain support, and being able to use their technology, are highly important to most younger adults. The theme of increased health records was also highly important to younger adults and often cited in the literature as perceived advantages by physicians (Malvey & Slovensky, 2014). The question that

involves being able to get support when it is needed most is also indicative of increased provider connectedness and relatedness being important to younger adults, which was relevant in the thematic analysis.

Conversely, some of the anticipated disadvantages of telehealth devices included perceived security and privacy of health data. Privacy and security issues are highly reported in the literature as significant barriers to telehealth adoption (Malvey & Slovensky, 2014). If younger adults find privacy and security to be one of the major disadvantages of telehealth systems, designers should work to ameliorate these concerns specifically. In a similar vein, the results on the disadvantage items adapted from Edwards et al. (2014) reaffirm these issues surrounding security, impersonality, and device errors, but they also show that overreliance on technology is of less concern.

In terms of contrasting the future concerns and perceived disadvantages, it is important to note that the cost of telehealth devices is perceived as a future concern much more than as a disadvantage, with many participants noting that cost serves as a limiting factor for their technology acceptance and usage of telehealth devices. Another frequent concern that was not seen as a disadvantage was the accuracy of treatment and diagnosis over a stable internet connection. While many of the other concern themes were relevant in the disadvantages themes, the question of perceived concerns was helpful in distinguishing what might actually prevent younger adults from interacting with telehealth devices in the future as opposed to simply inferring from what they consider to be disadvantages.

Future Directions

An overall goal of developers and designers will be to mediate some of these concerns, while still automating the technology. There is a fine line between how much of the technology should be automated and how much data providers should have access to. These are future issues that must be tackled. Research in the future should also compare specialized populations in terms of motivation and anticipated advantages and disadvantages to further hone in on the acceptance of the technology and potential usability issues and adoption barriers.

APPENDIX A: EDWARDS ET AL. (2014) ADVANTAGES & FREQUENCIES

1. Getting support in this way would help me to feel more independent.

	Frequency	Percent
Strongly Disagree	3	1.3
Disagree	17	7.6
Uncertain	64	28.7
Agree	112	50.2
Strongly Agree	27	12.1
Total	223	100.0

2. I would like being able to choose to get support at times that are best for me

	Frequency	Percent
Strongly Disagree	3	1.3
Disagree	2	.9
Uncertain	29	13.0
Agree	131	58.7
Strongly Agree	58	26.0
Total	223	100.0

3. I would like being able to get support in my own home

	Frequency	Percent
Strongly Disagree	1	.4
Disagree	8	3.6
Uncertain	29	13.0
Agree	128	57.4
Strongly Agree	57	25.6
Total	223	100.0

4. It would make me feel special to be getting 'extra' support in this way

	Frequency	Percent
Strongly Disagree	4	1.8
Disagree	30	13.5
Uncertain	70	31.4
Agree	92	41.3
Strongly Agree	27	12.1
Total	223	100.0

5. I would find it reassuring to be able to get support when I feel that I need it most

	Frequency	Percent
Strongly Disagree	1	.4
Disagree	8	3.6
Uncertain	26	11.7
Agree	123	55.2
Strongly Agree	65	29.1
Total	223	100.0

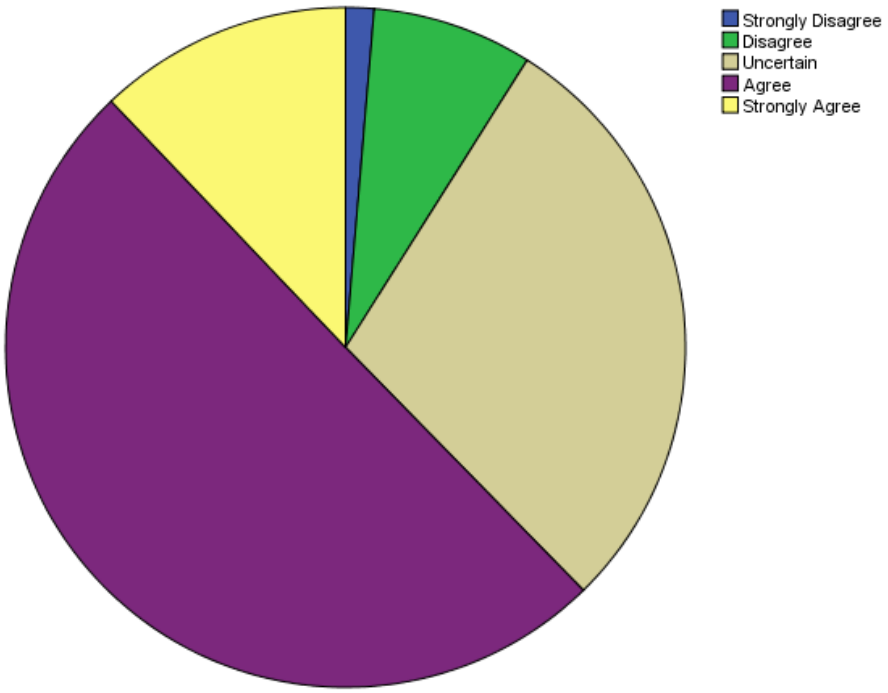
6. I could save money by not having to travel to appointments

	Frequency	Percent
Strongly Disagree	3	1.3
Disagree	13	5.8
Uncertain	32	14.3
Agree	105	47.1
Strongly Agree	70	31.4
Total	223	100.0

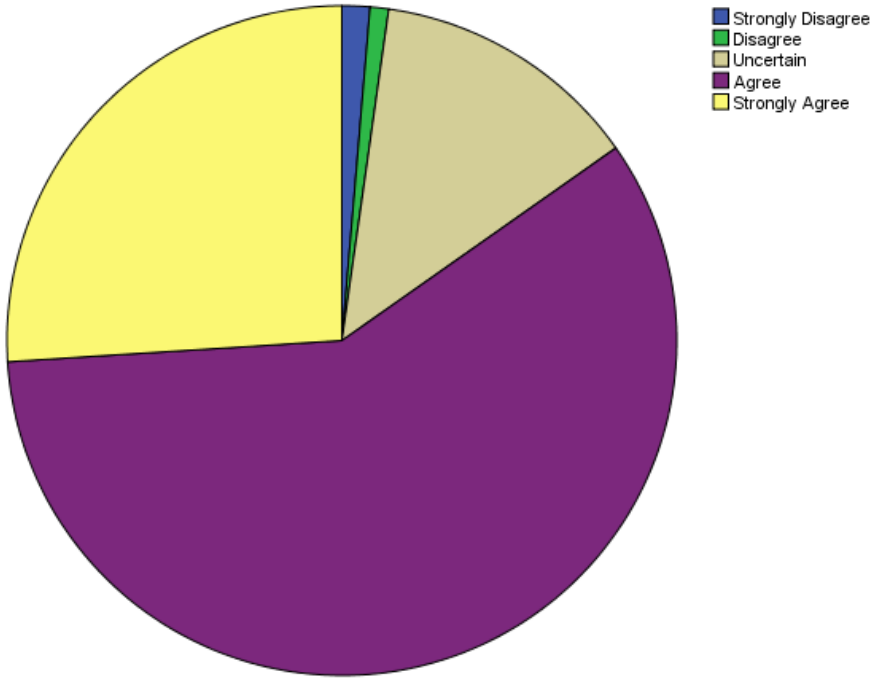
7. Getting support with my health by phone or computer would be valuable to me

	Frequency	Percent
Strongly Disagree	2	.9
Disagree	13	5.8
Uncertain	51	22.9
Agree	111	49.8
Strongly Agree	46	20.6
Total	223	100.0

1. Getting support in this way would help me to feel more independent.



2. I would like being able to choose to get support at times that are best for me.



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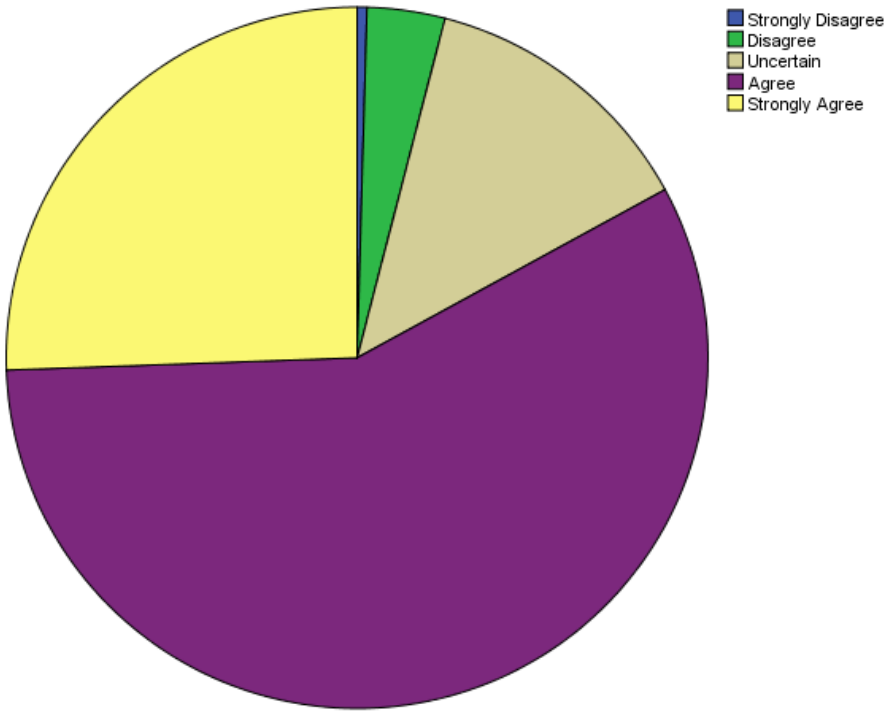

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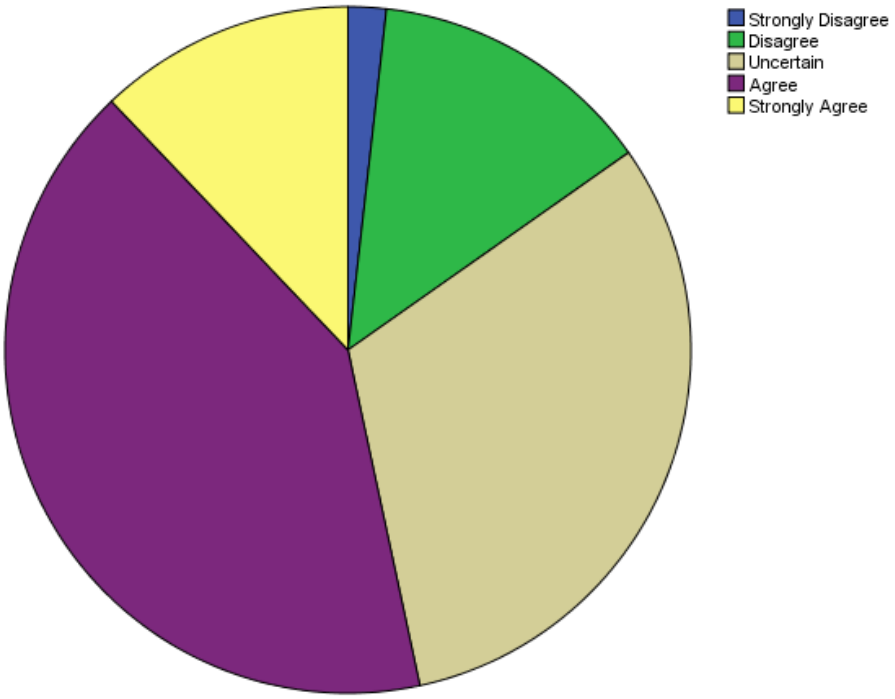
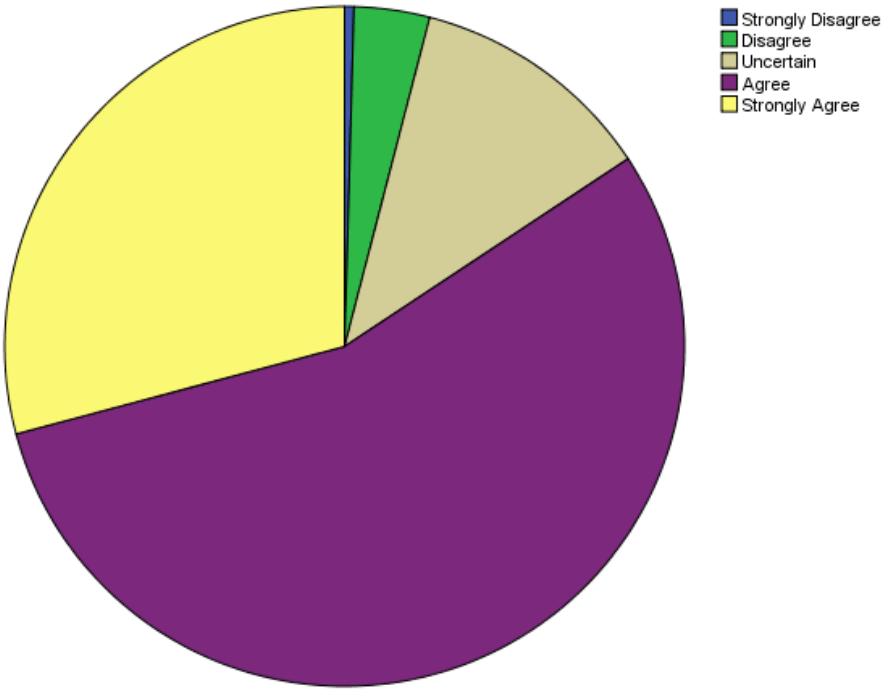
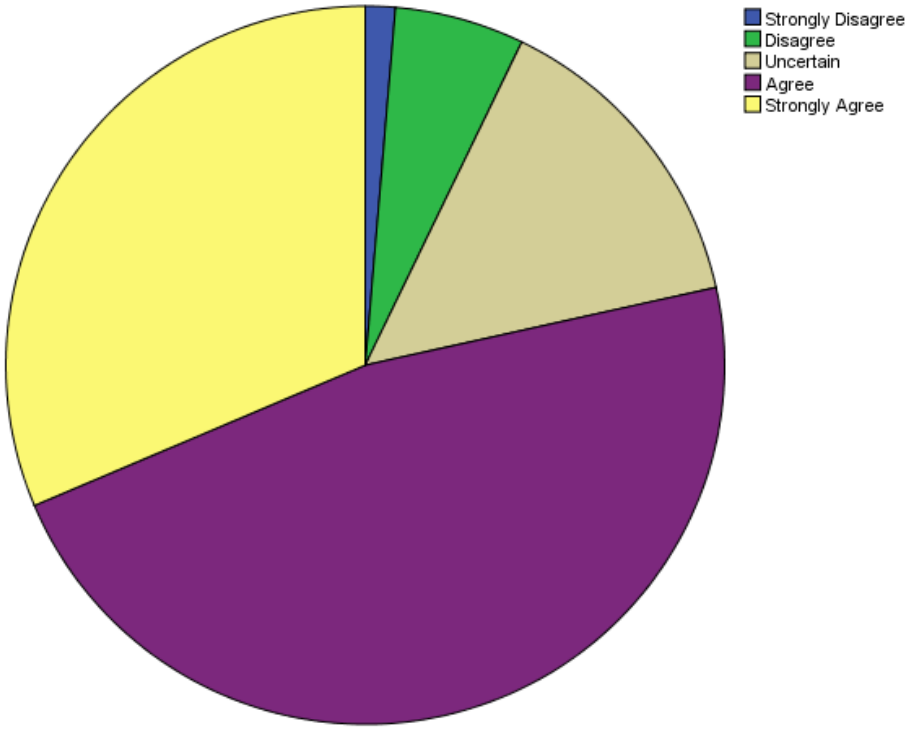


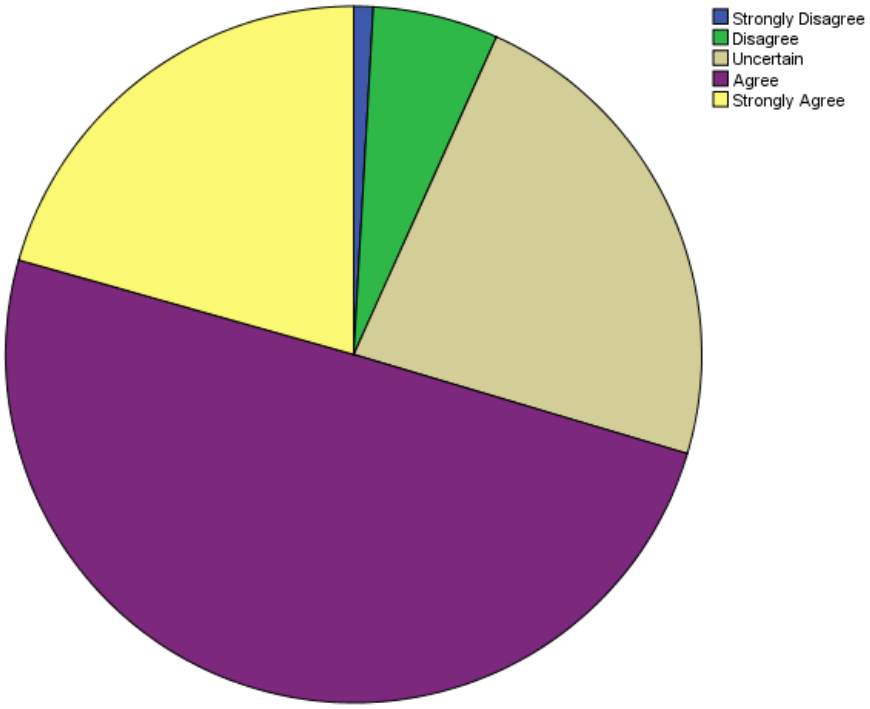
5. I would find it reassuring to be able to get support when I feel that I need it most.



6. I could save money by not having to travel to appointments.



7. Getting support with my health by phone or computer would be valuable to me.



APPENDIX B: EDWARDS ET AL. (2014) DISADVANTAGES & FREQUENCIES

1. I would worry about relying too much on the technology

	Frequency	Percent
Strongly Disagree	23	10.3
Disagree	59	26.5
Uncertain	43	19.3
Agree	71	31.8
Strongly Agree	27	12.1
Total	223	100.0

2. I would not want to discuss sensitive issues over the phone or using a computer

	Frequency	Percent
Strongly Disagree	12	5.4
Disagree	46	20.6
Uncertain	39	17.5
Agree	80	35.9
Strongly Agree	46	20.6
Total	223	100.0

3. I would be concerned about the security of the information that I give

	Frequency	Percent
Strongly Disagree	11	4.9
Disagree	22	9.9
Uncertain	36	16.1
Agree	89	39.9
Strongly Agree	65	29.1
Total	223	100.0

4. Getting support in this way would make me feel anxious about my health

	Frequency	Percent
Strongly Disagree	19	8.5
Disagree	64	28.7
Uncertain	88	39.5
Agree	40	17.9
Strongly Agree	12	5.4
Total	223	100.0

5. I would worry about the possibility of the equipment not working

	Frequency	Percent
Strongly Disagree	11	4.9
Disagree	25	11.2
Uncertain	46	20.6
Agree	103	46.2
Strongly Agree	38	17.0
Total	223	100.0

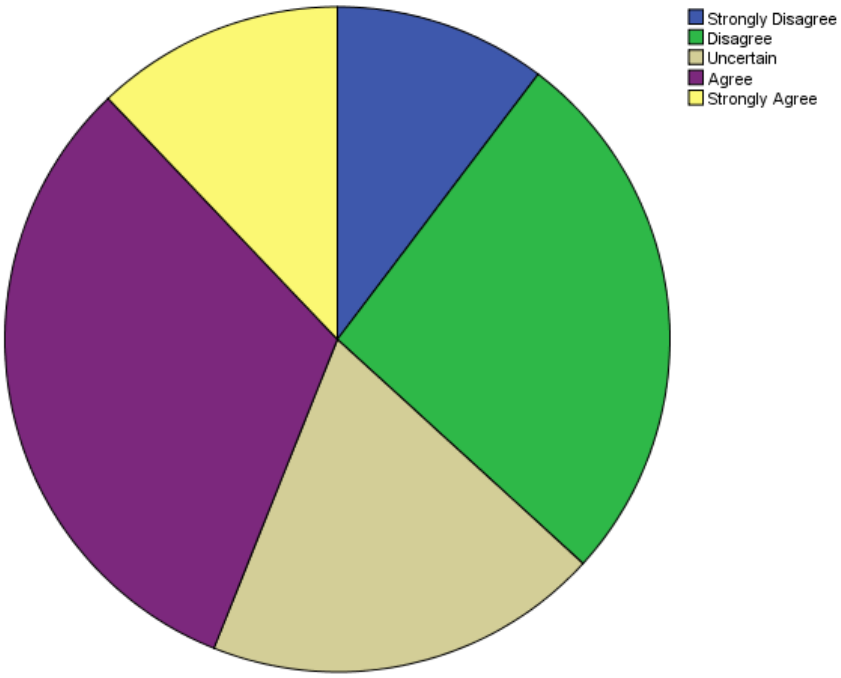
6. I would dislike speaking to someone other than a doctor or healthcare provider about my health

	Frequency	Percent
Strongly Disagree	12	5.4
Disagree	22	9.9
Uncertain	57	25.6
Agree	86	38.6
Strongly Agree	46	20.6
Total	223	100.0

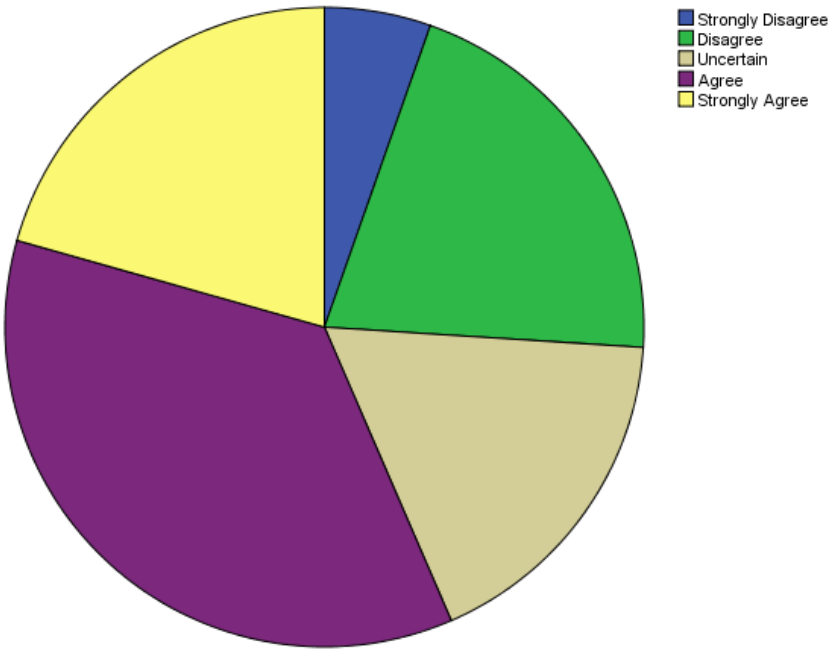
7. I would dislike being unable to see the person face-to-face

	Frequency	Percent
Strongly Disagree	13	5.8
Disagree	30	13.5
Uncertain	42	18.8
Agree	83	37.2
Strongly Agree	55	24.7
Total	223	100.0

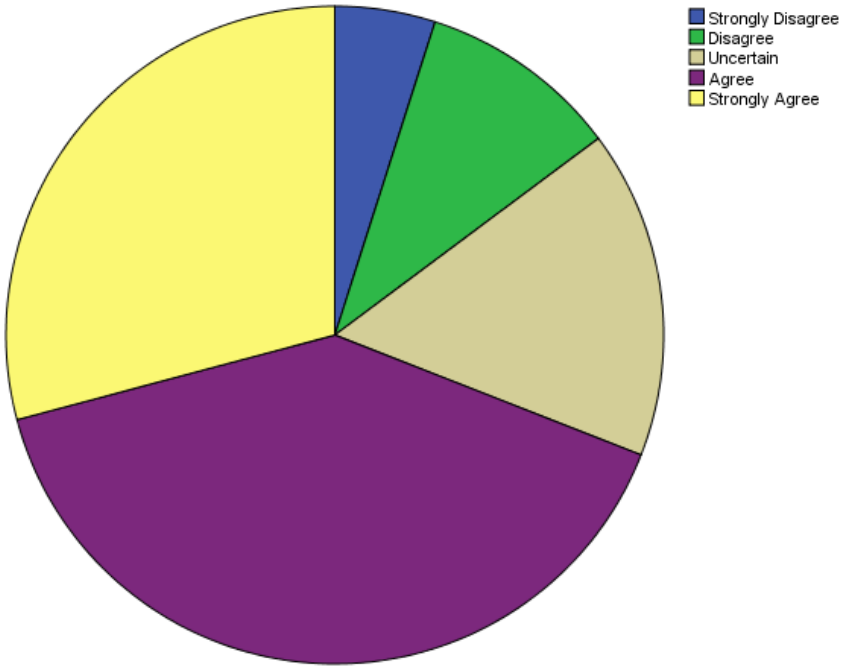
1. I would worry about relying too much on the technology.



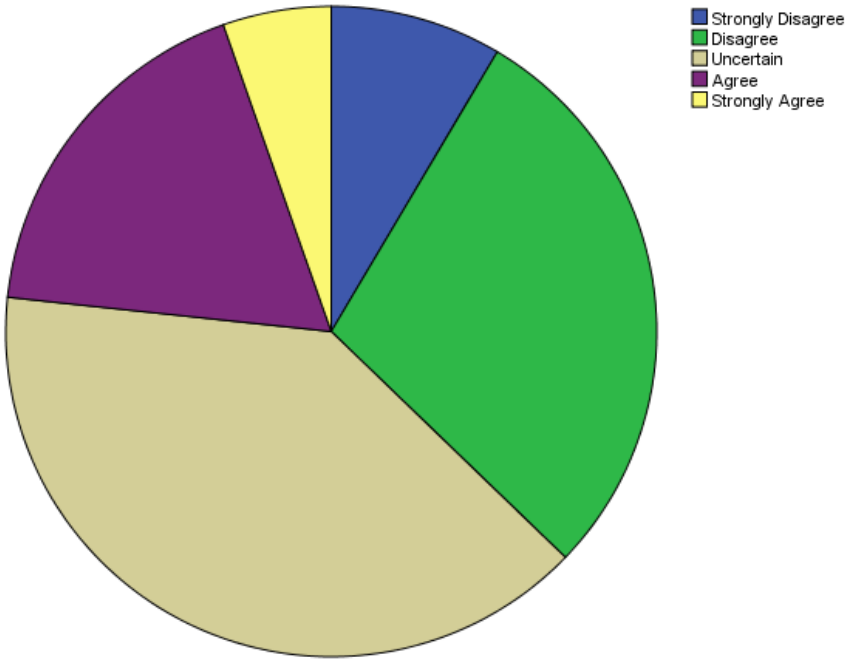
2. I would not want to discuss sensitive issues over the phone or using a computer.



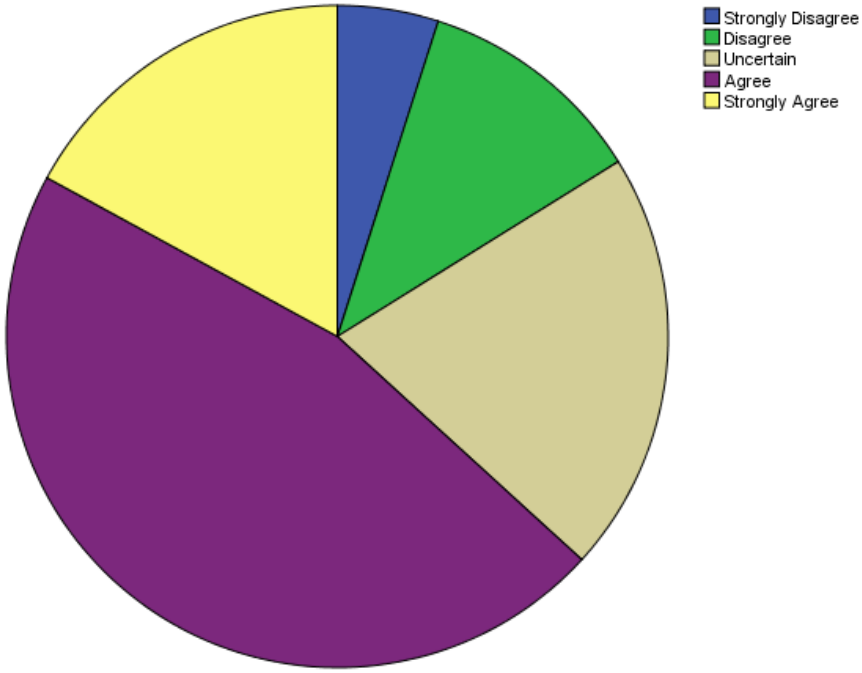
3. I would be concerned about the security of the information that I give.



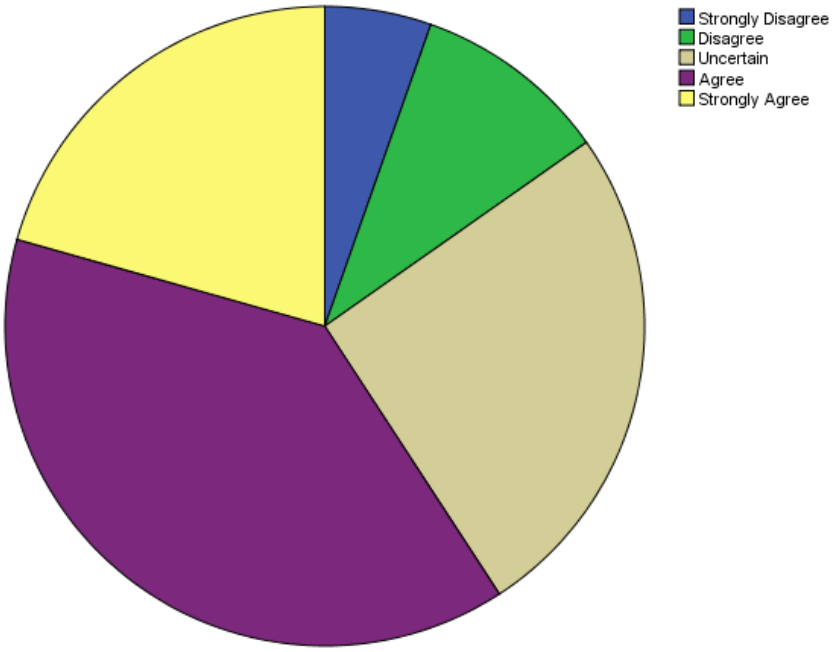
4. Getting support in this way would make me feel anxious about my health.



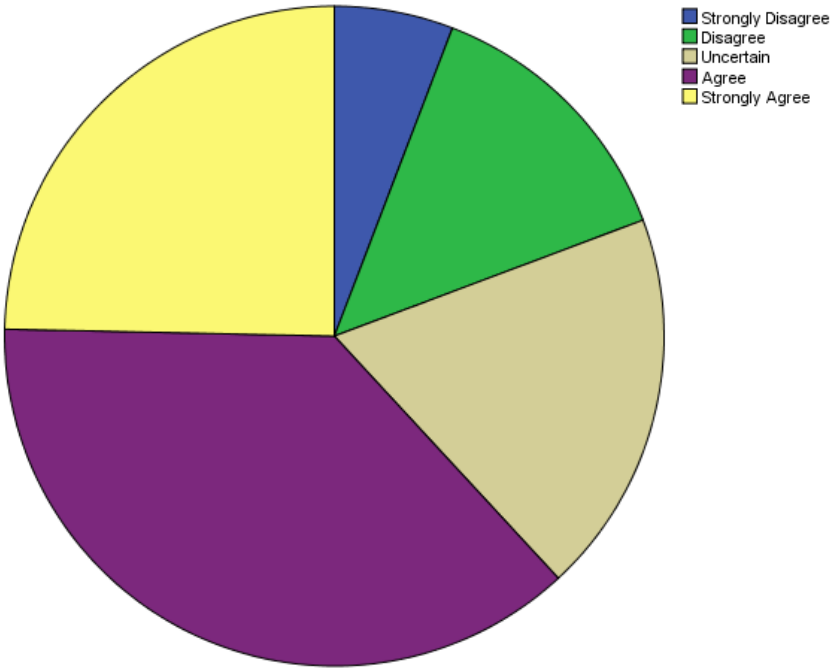
5. I would worry about the possibility of the equipment not working.



6. I would dislike speaking to someone other than a doctor or healthcare provider about my health.



7. I would dislike being unable to see the person face-to-face.



APPENDIX C: IRB APPROVAL LETTER

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Alexis R. Dewar** and Co-PIs: **James L. Szalma, Janan A. Smither, & Tyler P Bull**

Date: **November 24, 2014**

Dear Researcher:

On 11/24/2014, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Project Title:	Anticipated Telehealth Device Usage in Older and Younger Adults
Investigator:	Alexis R. Dewar
IRB Number:	SBE-14-10714
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Kanille Chap

IRB Coordinator

APPENDIX D: INFORMED CONSENT

Anticipated Telehealth Device Usage in Older and Younger Adults

Informed Consent

Principal Investigator(s): Lexi Dewar, B.S.
Co-Investigator: Tyler Bull, B.S., Undergratuate Honors in the Major Program

Faculty Supervisor: Janan Smither, Ph.D., James Szalma, Ph.D.

Investigational Site(s): University of Central Florida's Psychology Department

Introduction: Researchers at the University of Central Florida (UCF) study many topics. To do this we need the help of people who agree to take part in a research study. You are being invited to take part in a research study, which will include about 500-600 people at UCF and the surrounding community. You must be 18 years of age or older to be included in the research study and in normal cognitive health. The person doing this research is a undergraduate student in psychology. Because the researcher is an undergraduate student, they are being guided by Drs. Janan Smither and James Szalma, UCF faculty supervisors in the Deparment of Psychology.

What you should know about a research study:

- Someone will explain this research study to you.
- A research study is something you volunteer for.
- Whether or not you take part is up to you.
- You should take part in this study only because you want to.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.
- Whatever you decide it will not be held against you.
- Feel free to ask all the questions you want before you decide.

Purpose of the research study: The purpose of this study is to better understand how younger and older adults would anticipate using telehealth devices and applications in their everyday lives.

What you will be asked to do in the study: During this study, you will complete a series of surveys regarding telehealth devices and applications. We will also ask you questions regarding your demographics and about your general daily behaviors. You do not have to answer every question or complete every task. You will not lose any benefits if you skip questions or tasks.

Location: The survey will be administered in an online format and may be taken at various locations by all participants.

Time required: We expect that you will be in this research study for approximately 1 hour.

Risks: There are minimal risks associated with this study. Some questions may cause participants to feel discomfort, such as questions about healthy behaviors (i.e., do you exercise?) or wellness (i.e., have you visited a counselor in the past year?). Again, all participation is voluntary and these questions can be skipped. No questions will be forced choice. If a participant would like to discontinue the study, they may do so at any time without penalty.

Benefits: There are no potential benefits for the participant other than knowledge gained about telehealth devices from the study .

Compensation or payment: There is no compensation or payment for taking part in this study. However, you may be enrolled in a course that allows you to participate for SONA credit, or your professor may allow you to participate in SONA for extra credit in the course. This is the professor's discretion.

Anonymous research: This study is anonymous. That means that no one, not even members of the research team, will know that the information you gave came from you.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints, please talk to Tyler Bull, Undergraduate Honors in Major Program, Psychology Department, College of Sciences, email address: tpbull@knights.ucf.edu or Lexi Dewar, Graduate Student, Psychology Program, College of Sciences, email address: dewar@knights.ucf.edu.

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901. You may also talk to them for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

Withdrawing from the study: You are volunteering to participate in this research and you can withdrawl from the study at any time. If you decide to leave the research, please contact the principal investigator. If you were recruited via SONA and decide to withdraw from the study, you will earn partial SONA credits.

Results of the research: The results of this research will not be shared.

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