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Senior's Health Information Website: Technology Acceptance Related To Information Retention

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SENIOR'S HEALTH INFORMATION WEBSITE: TECHNOLOGY ACCEPTANCE RELATED TO INFORMATION RETENTION

by

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ABSTRACT

The formative study investigated health information for seniors on the Internet with consideration of usability of the selected system, user's perceived ease of use, perceived usefulness, system use, and performance, i.e. information retention. A theoretical model was developed by the researcher, i.e. JAM's Senior Health Information Technology Acceptance Model, as an enhanced version of the traditional Davis Technology Acceptance Model. The new model provided the critical relationship between the senior health information system and other technology acceptance components. Computer self-efficacy was added to the hypothetical model to better explain the seniors' technology usage and performance.

The hypotheses and the research plan included: four professional experts, who assessed the site for usability, and 68 of 145 seniors who began the survey completed a three-part senior participant survey. Data was collected by a third party and the author. Implications for seniors, professionals, and society are presented. The senior population is the subject of the research. Professionals working with seniors, the Internet, health information, and technology acceptance are served by the formative study to further clarify the relationship of the issues. The topic is considered a societal issue as a large segment of the population is composed of seniors. Their welfare and interests impact society and other generations.

The results suggested computer self-efficacy is irrelevant for perceived ease of use and perceived usefulness however self-efficacy contributed to information retention. Usability affects perceived ease of use and perceived usefulness. There is a highly significant, though not very strong, relation between those variables. Perceived usefulness is a good indicator of a return visit to the site and senior recommendations of the site to others. These are two new variables

that were not included in the model. There is no relationship between usability and computer self-efficacy. There was significance between usability and system use, but little relevance has pointed toward information retention (IR). The results of the analysis suggest that the hypothesized model information retention level did not predict senior IR based on human factor professionals' and senior users' usability ratings. Attrition according to qualitative feedback was the result of browser and equipment issues, ease of use and navigation. Future research endeavors should be devoted to usability and use of other systems for the senior population.

To my husband, Fred, and my brother, John, who are brilliant, honorable, and ever faithful. You are my inspiration.

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LIST OF ACRONYMS/ABBREVIATIONS

AT	attitude
CSE	computer self-efficacy
HFP	human factors professional
HI	health information
IR	information retention
IRP	information retention pre-assessment
IRO	information retention post-assessment
IS	information system/s
JAM	Jane A. Madsen
NIA	National Institutes on Aging
NIH	National Institute for Health
NLM	National Library of Medicine
PEU	perceived ease of use
PU	perceived usefulness
R1	Return to site
R2	Recommend to others
SE	self-efficacy
SrHI-TAM	Senior Health Information Technology Acceptance Model
SU	system usage/potential system usage
TAM	Technology Acceptance Model

TRA	Theory of Reasoned Action
U	usability

CHAPTER 1: INTRODUCTION

Introduction

The purpose of the formative study was to investigate the effect of usability, computer self-efficacy and technology acceptance on seniors' information retention using a theoretical model developed by the researcher, Madsen's Senior Health Information Technology Acceptance Model (JAM's SrHI-TAM). SrHI-TAM was an enhanced version of the original Davis Technology Acceptance Model (1986). The new model provided the critical relationship between the senior health information system and technology acceptance components, i.e. access health information (HI), user's perceived ease of use (PEU), perceived usefulness (PU), system usage (SU), and performance, i.e. information retention (IR). Computer self-efficacy (CSE) and performance were added to the hypothetical model to better explain the seniors' attitude towards technology usage and IR.

The Internet has been recognized as an efficient medium to disseminate health information, with more than 17,000 Internet websites devoted to health issues (Fox & Rainie, 2004; Kats & Rice, 2000). Some of these websites have been specifically designed and developed for senior adults. According to Nielsen (1993), the number of senior health information websites is increasing; however, there are unique usability issues and concerns, which need to be considered in the design of a website for seniors. Many seniors have age-related physical and/or cognitive difficulties, which could affect usage of the Internet (Hendrix, 2000; Nahm & Resnick, 2001; Sherer, 1996) and access to health information sites and information retention.

Background of Study

A survey in 2004 showed that 22% of older adults had used online services (Fox, 2004). Elderly people constitute a growing group of computer users and information seekers on the Internet, and one of the favorite topics of the seniors is access to health information (Morrell, Mayhorn, & Bennett, 2000). The elderly are big consumers of health information and services, and the Internet can offer unparalleled opportunities to acquire health information (Licciardone, 2001; Marwick, 1999).

According to Nielsen (1993) and Preece (2000), high quality, i.e. usable, websites that allow users to perform their tasks intuitively are particularly important to older adults. Hendrix (2000) stated that older adults may not be familiar with the Internet and may require pages specially designed to meet their needs. Websites for seniors should be designed and developed to be user-friendly, as many of the potential users are learning the skills of Internet navigation (Sherson, 2002).

The increased number of senior consumers using the Internet is the result of several factors. These include the fact that the largest U.S. generation, Baby Boomers born between 1943 and 1960, are entering the senior ranks (Lancaster & Stillman, 2002). The phenomenon can be attributed to increased longevity of seniors due to improved health, nutrition, and lifestyle. According to the U.S. Census Bureau (2005), by the year 2030, it is projected that 40% of the U.S. population will be comprised of people 50 years and older.

Purpose of Study

The purpose of the study is to investigate the relationship between technology acceptance, usability, and performance of seniors in accessing health information through the

Internet. JAM's SrHI-TAM was modified from Davis' 1993 TAM to include the computer self-efficacy and performance outcome, i.e. information retention.

Looking at the aging population with afocus on health information on the Internet accompanied by demonstration of newly acquired information, was to consider CSE, PU, PEU, SU, and IR through implementation of JAM's SrHI-TAM. The researcher was concerned with the significance of contributing a formative study for scholarly research and literature relative to the growing senior population, health information, technology acceptance, and demonstrated information retention, as well as providing research to serve as a basis for future studies. The rationale for the research was presented by identifying what was known, what the gap was, the importance of the study, the hypotheses, limitations, methodology, and theory.

In order to investigate the technology acceptance and usability features specific to seniors, it was incumbent upon the researcher to choose an appropriate HI site for the study. Four design experts and the senior participants assessed the selected health information site for usability. Cognitive and physical skill limitations of the aged were defined and considered, as these should drive website development and design (Fuccella, Pizzolato, Franks, 1998).

Modifications to a website to technically adapt to aging changes are necessary for better usability (U) design, for the senior audience and enhance information retention (Alpay, Toussaint, Ezendam, Graafmans, & Westendop, 2004; O'Hara, 2004). The National Institute on Aging (NIA) (2002a), Nielsen (2002), and Hollis-Sawyer and Sterns (1999) have developed guidelines to assist web designers to create web pages that can be easily navigated by senior adults and provide accommodations for cognitive and physical limitations that are unique to seniors (Fisk, Meyer, Rogers, & Walker, 1998).

This issue was important because the Internet was recognized as an efficient medium to disseminate health information. Research has been done on the individual topics of SU, U, CSE, and IR (Gustafson, Hawking, & Boberg, 2001). There is a paucity of information combining these topics.

Since the senior group, a minority, but large segment of the US population, was concerned and interested in healthcare and medicine (Morrell et al., 2000; Williamson, 1997, 1999), it is incumbent on society to provide usable, useful tools for acquiring and retaining health information. Senior Internet users showed they were interested in HI and liked to access information from websites that provided details unique to their population (Norris, 2001). In using the Internet, seniors had unique cognitive and physical limitations (O'Hara, 2004). Though websites were targeted at the senior audience, some lacked the needed accommodations for seniors. Such accommodations have been recommended by the NIA (2002a) in "Making Your Web Site Senior Friendly."

In addition, senior health information on the Internet was a public policy issue with social implications. The federal government recognized the societal concerns by appropriating millions of dollars in federal funding for research on senior adult health information dissemination (Forkner-Dunn, 2003). The website selected for the formative study, National Institutes of Health (NIH) Senior Health, was a federally funded site sponsored by the National Institute on Aging (NIA), the U.S. National Library of Medicine (NLM), the NIH, and the U.S. Department of Health & Human Services (HHS), according to nihseniorhealth.gov (NIH, 2006). The site has been updated on a regular basis by reviewing and improving the site using feedback from professionals and the audiences (Nahm, Preece, Resnick, & Mills, 2004).

Rationale for the Study

The problem was that health information on the Internet does not accommodate the senior audience. It was not user-friendly and, therefore, did not provide the needed and desired service or information to the targeted audience. This negatively impacted retention of new information (DiMaggio, Hargittai, Neuman, 2001).

Modifications to a website to technically adapt to aging changes are necessary for improved usability design for the senior audience and enhancement IR (O'Hara, 2004; Alpay et al., 2004). The National Institute on Aging (NIA) (2002b), Nielsen (2002), and Hollis-Sawyer and Sterns (1999) have developed guidelines to assist web designers in creating web pages that can be easily navigated by senior adults and provide accommodations for cognitive and physical limitations that are unique to mature adults (Fisk et al., 1998).

The Gap

The Internet offers seniors immediate access to health resources that might not otherwise be available. Seniors, however, may encounter Internet barriers associated with normal aging and lower educational levels. Becker (2004) stated the NIA in 2002 developed accommodation guidelines for developing sites for seniors. These recommendations were used to assess the usability of 125 websites offering health resources. Performance, translation, and reading complexity were also assessed. Results showed that many of the sampled sites were not senior-friendly. According to Becker's research, a third of the sample sites required a college education to comprehend extracted health information.

Research Questions / Problem Statement

Numerous health information websites have been created for senior adult audiences; however, not all are user-friendly (Sherson, 2002). The websites vary in design and attributes targeted at seniors and their maladies. To accommodate seniors, it is important to implement design features, for unique physical and cognitive limitations, that enhance PEU and PU of the website. The NIA has developed guidelines to assist designers in making websites easily navigable and usable, with consideration for cognitive and psychomotor limitations of seniors. The study has identified features and presentations appropriate for senior Internet websites that were presented by NIH (2006), NIA (2002a), Hode & Lindberg (2004), Park (2004), Seels & Glasgow (1998), Selim (2003), Nielsen & Tabir (2002), and Hollis-Sawyer & Sterns (1999). The researcher surveyed both human factor professional (HFP) usability experts and potential senior users for identified website characteristics and tested new information acquisition from the website. The characteristics were consolidated features incorporated into the survey. Pre- and post-assessments were administered using nihseniorhealth.gov as the system, which is a website that was designed for seniors, age 50 plus (NIH, 2006). Age 50 was selected as there are an increased number of medical concerns that begin to surface at that age. These include colorectal cancer, macular degeneration, and deterioration due to sleep quality, weak bones or osteoporosis, and neurological deterioration, to name a few (Alliance for Aging Research, 2003; PubMed, 1995; The University of Chicago Hospitals, 2000; US Department of Health and Human Services, 2004).

The research question is: What is the relationship between a usable SrHi site, technology acceptance and user performance, i.e. IR? A modified version of Davis' 1986 and 1993 TAM was used to focus on U, S, CSE, PEU, PU, SU, and IR. The investigation spotlighted seniors and

HI on the Internet, using the two sections of the colorectal cancer portion of the NIH Senior Health site, as the agent.

Hypotheses

It is hypothesized that the Internet HI website's usability ratings by HFP usability experts and users predict IR levels. Positive usability ratings relate positively to PEU, PU, and IR senior adult IR. The general and specific study hypotheses were:

H_1: Usability (U) ratings of the system (S) by HFPs are consistent with senior participants' ratings of U

H_2: System (S) HI website's usability (U) ratings by HFPs and senior users predict Information Retention post-test (IRO) levels, through other determinants in the model

H_3: PEU and PU are positively affected by U

H_4: SU for IR purposes is positively affected by PEU, PU and, that is through other determinants in the model

$SubH_1$: IRO is positively affected by SU

$SubH_2$: IRP (pre-assessment) score improved on IRO (post-assessment)

These hypotheses were tailored from Davis (1993).

Significance of Study

According to Becker (2005) "seniors are encountering website usability barriers that may be difficult to overcome" (p. 388). This is important because seniors are the fastest going segment of Internet users, increasing at 15% per year (Coulson, 2000). The growth can be attributed to the aging Baby Boomers and increases in life expectancy. The Administration on Aging (2002; 2004) reports seniors age 50 and older comprise 12.7% of the U.S. population; and

this age group should account for 20% of the population by 2030. In addition, the Department of Commerce reports "the older adult population was the fastest growing computer market in 2000; and coincidentally, comprised 80 million web users" (Becker, 2005).

Accessing Internet sites can be difficult for seniors due to vision, cognition, and physical impairments associated with the aging process. As a result, complex navigation schemes, poorly designed search capabilities, and cluttered web pages negatively affect the older adult's online experience (Nielsen & Tabir, 2002; Nielsen Norman Group, 2006).

Design and Methodology

Validation of an appropriate website for senior HI research was accomplished by using four HFPs, i.e. usability experts, with a minimum of six years experience as professional designers to review the website prior to the senior survey. These professionals responded to a questionnaire to review usability of the health information Internet site for seniors. Once the HFP assessment was completed and confirmed, the site possessed features defined appropriate for the senior audience. The seniors completed a pre-assessment prior to accessing the health information site. This provided the baseline data. After the pre-assessment was completed, the senior participants received instructions to access the HI site. Their navigation was not timed due to the diverse level of cognitive and physical skills of senior adults. After completing this activity, the senior participants completed a post-assessment. Quantitative methods were used to compare pre-assessment and post-assessment responses, which identified prior knowledge with specific knowledge gained during the online activity. The professionals' assessment of the site was compared to the users' assessment. The research was used to determine the relationships existing between the S, U, CSE, PEU and PU, SU, and IR. There was no manipulation of the

variables, as the investigation focused on the extent to which the variables were related. The strength and direction of the relationship between the variables was described by means of a quantitative index to clarify relationships and patterns among the variables. Multiple Linear Regression was used to help analyze the data. The researcher described the relationship and patterns of the studied variables through JAM's SrHI-TAM, from the system through user performance.

Study Limitations

Senior users' Internet skills varied and were limited, even though a prerequisite of participation in the study was Internet usage skills. Moreover, individual physical and cognitive limitations differed. In addition, different types of computers, settings, and Internet services influenced the perception by participants and impacted the rating. Validity of the study relied on participants' honest responses to the questionnaires and individual responses without the help of other individuals. The costs were limited to the expense of the survey administration, which was collaboratively administered through an online survey organization, QuestionPro; replication of documents and manuscripts; and time and effort of dissertation committee members and the candidate.

According to literature, seniors span across two generations, but the onset of medical problems unique to their age makes them a homogenous group. Purposively age 50 was selected is that it seems logical because as some organizations use 50, and several maladies unique to seniors begin to be diagnosed at age 50, i.e. osteoporosis, weak bones, colorectal cancer, and macular degeneration to name a few. The American Association of Retired Persons (AARP) (2007) stated "the Foundation leads positive social change to help people 50 and older ……."

NIH Senior Health (2007) stated in the colorectal section that "individuals begin screening at age 50." Also, materials in senior sites apply to individuals age 50 and older. Colorectal cancer was selected as the agent, as it was a topic that seniors are interested in because screening generally starts at age 50 (NIH, 2006).

Assumptions

The assumptions of the study were the sample participants used the targeted site, nihseniorhealth.gov. Seniors responded to the pre and post-questionnaire honestly. The participants' responses were based on their beliefs and knowledge. The responses were for betterment of design of health information on the Internet for individuals 50 and older.

Definition of Terms

The following terms are key terms that need explanatory definitions, and for this study, the following definitions were used:

Attitude (AT): An opinion about use of the system

Computer self-efficacy (CSE): The reflection of one's beliefs about the ability to use computers effectively (Compeau & Higgins, 1995b). An individual's belief in their ability to perform a particular task using the computer (Bandura, 1997)

Health Information (HI): Information about health issues

Health Information website: An Internet website that offers information about health issues

Human Factors Professional (HFP): An expert in usability with the minimum of a master's degree and six years work experience in design and development of website materials for a targeted audience

Information Retention (IR): Human memory encoding, storage and retrieval. For this study, pre-assessments will show content knowledge prior to navigating the website, and post-assessments demonstrate content knowledge after navigation of the site. The two tests will measure the user's prior and post content knowledge.

Internet: The World Wide Web

National Institutes on Aging (NIA): One of 27 institutes and Centers of NIH, leads a broad scientific effort to understand the nature of aging and to extend the healthy, active years of life (National Institutes of Aging, 2007)

National Institute for Health (NIH): A part of the U.S. Department of Health and Human Services; it is the primary Federal agency for conducting and supporting medical research and making important medical discoveries that improve health and save lives (National Institute for Health, 2007)

National Library of Medicine (NLM): The world's largest medical library (National Library of Medicine, 2007)

Perceived Ease of Use (PEU): The degree to which a person believes that using a particular system would be free from effort (Davis, 1989b).

Perceived Usefulness (PU): Usefulness value is how the task relates to future goals (Pintrich & Schunk, 1996). It has instrumentality and utility. Utility is a more external or extrinsic reason for engaging in a task. Eccles and Wigfield (1995) have provided correlational evidence that an individual's interest, importance, and usefulness toward a task will affect task choice. Davis (1989a) defined it as the degree to which a person believes that using a particular system would enhance their performance.

Projected System Use (PSU): Usage and intentions to use the Sr HI system

Self-efficacy (SE): According to Bandura's work (1997) "(the) beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). According to Condly (1999) "From the outset it must be emphasized that self-efficacy is a perception; that is, it is a psychological construct whose existence is inferred from behavior and self-report."

Senior Health Information TAM (SrHI-TAM): An information systems theory designed to model how senior adults accept a system and demonstrates retention of health information that is acquired through use of the system

Seniors: Mature adults age 50 and older with Internet knowledge and skills

System Usage (SU): Potential and recommended usage of the website by senior participants

Technology Acceptance Model (TAM): An information systems theory that models how users accept and use a system. The model suggests a number of factors influence their decision about how and when they will use it.

Theory of Reasoned Action (TRA): A person's behavior is predicted by their attitude toward the particular behavior and how they think other people would view them if they did the actual behavior. Both of those factors determine a person's behavior intention, which leads to whether the behavior is done or not.

Usability (U): The utility of a system. For purpose of this study, usability refers to the design and development of a website to meet the needs and desires of the audience, in this case seniors. From the design perspective the term utility is equally applicable. Usability applies to all the aspects of a website with which a user might interact (Nielsen, 1993). Davis' (1989)

definition included the degree to which a person believes that using a particular system would be free from effort.

Summary

The purpose of the study was to investigate the effect of usability and technology acceptance on seniors' information retention using a theoretical model developed by the researcher, JAM's Senior Health Information Technology Acceptance Model (SrHI-TAM), which was a hybrid of Davis' (1993) TAM. The new model included health information (HI), user's perceived ease of use (PEU), perceived usefulness (PU), system usage (SU), and performance, i.e. information retention (IR). The background of the study included a growing population of seniors, increased use of technology, and usability of Internet sites designed for a targeted audience with consideration for inherent characteristics and limitations; and presentation of a topic of interest to the group. The focused problem was that sites on the Internet do not accommodate the senior audience. A related question is: does the site accommodate the audience and provide relevant information and is that information retained? This is framed in JAM's SrHi-TAM. The hypotheses are that there is a positive relationship between a site assigned high usability design ratings by experts and seniors resulting in new content retention by seniors.

In addition, although HI sites are increasingly being used, little theory-driven research has examined the determinants associated with use of a system when that system is used to provide HI. Equally important, there was virtually no research found on HI systems that examined the impact of specific system characteristics that are thought to be critical for such systems. Further, studies examining the determinants associated with Internet use have not examined specific system characteristics that are the focus of this study (Carswell & Venkatesh,

2002) or have not tested models which hypothesize that such characteristics are determinants of Internet use (Selim, 2003). By examining the impact of specific system characteristics, the research expanded the knowledge base on important determinants of SrHI Internet use.

CHAPTER 2: LITERATURE REVIEW

Introduction

The review of literature is divided into six sections with theoretical concepts and research related to (1) usability (U) and the system (S), nihseniorhealth.gov; (2) seniors, the targeted population and unique limitations of the group; (3) Davis's Technology Acceptance Model (TAM) modified as Madsen's Senior Health Information Technology Acceptance Model (JAM's SrHI-TAM); (4) computer self-efficacy (CSE) and attitude; (5) perceived ease of use (PEU) and usefulness (PU); (6) system use (SU); and (7) user information retention (IR). The first and second topics, i.e. U, S, and selection of the specific website, are introduced in the beginning. The second section defines the targeted population and unique limitations of the group's members. The third section explains TAM and SrHI-TAM. The fourth section includes CSE and attitude toward Internet usage. The fifth section describes PEU and PU of the system. The sixth section includes SU and potential usage. The seventh section depicts the outcome variable, i.e. IR.

The research literature revealed scant information on website usability tests of senior sites (Nahm et al., 2004). The first step of this study was to explore the usability of nihseniorhealth.gov, designed for adults over 50 using JAM's SrHI-TAM. The website was selected for the study because it has been identified as a credible design for seniors. Researchers from the University of Maryland made this designation when researching websites designated for seniors.

Health information websites for seniors are numerous (Pend Oreille County Library District, 2006). Some provide features and tools that are difficult to navigate, and therefore do

not meet the needs and desires of senior adults. Even though several are identified as senior sites, there is a paucity of research findings available on the sites designated for seniors (Nahm et al., 2004).

Usability of Health Information on the Internet: The System (S) nihseniorhealth

The website selected for the formative study was nihseniorhealth.gov, an authoritative website with health information specifically for senior adults. It represents the collaborative efforts of two organizations interested in both seniors and health, the National Institute on Aging and the National Institutes of Health. The U.S. National Library of Medicine and the U.S. Department of Health and Human Services contributed support (NIH Senior Health, 2006).

Colorectal cancer was selected as the health topic because it is popular with seniors. According to the National Cancer Institute (2007), in the U.S., colorectal cancer is the fourth most common cancer for men and women (National Institute on Health, 2007). Most seniors 50 and older will be introduced to colorectal screening. Professionals in the health community suggest screening begins at age 50 (NIH Senior Health, 2005).

Senior Adults

According to the National Older Driver Research and Training Center (2004) the "graying of America" is a reality, not just a prediction. The United States had 13% of its population aged 65 and over. The nation has never faced this large a number of senior citizens in the past. The U.S. 2004 Census predictions indicated that by the year 2050 there will be over 150 million adults over age 50 (US Census Bureau, 2005). Putting this into perspective with society's increased use of technology, this segment of the population needed and deserved information focused on meeting the needs of the over 50 age group.

The senior group has limitations due to cognitive and psychomotor changes (Salthouse & Babcock, 1991). Several changes occur with aging that contribute to seniors' CSE, PEU, PU, SU, and IR problems. These include cognitive and psychomotor functions, such as a decline in working memory and reliability of mental functioning (Craik & Salthouse, 2000; Fisk & Rogers, 2002). Seniors experience changes in psychomotor functions that result in slower response times and impaired motor coordination and dexterity (Salthouse, 1996; Smith, Sharit, & Czaja, 1999).

Cognitive Limitations

The aging process is accompanied by cognitive changes. For older adults, this includes declines in perception, memory, and spatial ability. These declines may impair performance of Internet tasks (Czaja & Sharit, 1998). Cognitive declines may negatively impact other adult abilities to acquire knowledge of Internet usage (Craik & Salthouse, 2000). In addition, seniors experience a generalized slowing of cognitive processes as measured in perceptual speed tasks (Salthouse & Babcock, 1991). Numerous studies report that older adults require considerably more time than young adults to complete Internet tasks (Morrell, Mayhorn, & Bennett, 2000). Older adults will not learn if the material is presented too fast. This may result in frustration and de-motivation when attempting Internet tasks.

A number of factors influenced cognitive performance, including processing speed and cognitive resources. Researchers have concluded that age-related differences are associated with processing speed and cognitive resources. Processing speed and cognitive resources are closely interdependent in working memory. It is important to understand working memory changes with aging (Rypma & D'Esposito, 2000).

If information is processed, the information is converted into a form of response (verbal or spatial) held in working memory, and then stored in long-term memory for use at another time (Baddeley, 1981). Several researchers (Salthouse & Babcock., 1991; Swanson, 1999) suggested that age-related performance of older adults is characterized by the inability to retain information in memory while simultaneously processing other information. The findings about working memory provided several conclusions for older adults and their ability to acquire computer skills. Older adults could be expected to follow simple, clear instructions just as well as younger adults. As the demands of performing a computer task become more complex, it was expected that older adults would not perform as well as younger adults (Salthouse, 1996). Older adults using the Internet would be expected to have more problems performing computer tasks compared to younger adults because of increased requirements on working memory (Foos, 1989).

According to Hawthorn (2000), reducing the interface demands on an older adult's working memory would decrease the slowing of working memory. Interface demands were elements of the program interface, i.e. text, screenshots, animation, that required the working memory to process the information being conveyed. To help reduce the interface demands, design of interfaces should emphasize simplicity, avoid distractions, and present lists more frequently than paragraphs to display information (Mead, Batsakes, Fisk, & Mykityshyn, 1999).

Research showed that the ability to perform some mental operations decreased with age (Rypma & D'Esposito, 2000). These operations included the ability to simultaneously remember and process new information, to perform complex cognitive tasks, and to comprehend text (Craik & Salthouse, 2000). Although these changes were not usually dramatic, their presence can interfere with the performance of some daily tasks such as using a computer (Czaja & Sharit, 1998).

Older Adults' Abilities

Chronological age is associated with declines in all sensory modalities (Schneider & Pichora-Fuller, 2000). Age-related declines in vision seemed to be the most prevalent within the context of Internet use. Presbyopia, the reduced ability to focus on objects that are a short distance away, might diminish an older adult's ability to see stimuli on the Internet screen. This visual condition becomes more apparent in middle age and older (MedlinePlus, 2007). Corrective lens may compensate for the decreases in perceptual abilities. Other methods of accommodation included changing the settings on the Internet and making the font larger. Some seniors experienced sensitivity to the glare of the Internet screen. This might hinder their ability to operate the Internet equipment. Adjusting the lighting in the room, angling the Internet screen, or using a screen cover designed to reduce glare could reduce the glare and help with vision (Smith et al., 1999).

Some older adults experience declines in motor movement. With increased age, motor functions slowed and movements may be more difficult, with deficits in coordination (Vercruyssen, 1997). The Internet interaction usually required the use of input devices. Older adults might have difficulty manipulating a computer mouse or keyboard (Smith, et al., 1999; Walker, Philbin, & Fisk, 1997). Older adults display deficits in pointing and clicking on specific objects, clicking and dragging objects, and single or double clicking. Overcoming these problems could be accomplished through playing games, which provide practice with pointing, clicking, and dragging. Other accommodations include changing the speed of double clicking and making use of the keyboard. Accommodations, such as adaptive devices, i.e. specialty mouses and keyboards, as well as practice improve motor skills. This is confirmed by research (Charness, Bosman & Elliott, 1995; Walker et al., 1997).

Another potential barrier to usage could be an excessive amount of material. Long procedures that have a large number of steps might seriously tax working memory and the ability to store and process information in the memory of older persons. Another potential cognitive concern is the correct sequence of procedural steps (Salthouse, 1992). When browsing a website, older users must remember what information they want to access, where they have looked for it, and where they are located (Stronge, Walker, & Rogers, 2002). As a result of declining working memory capacity, older adults may revisit pages within a website and have trouble keeping track of the relationship of the current page they are visiting to other linked web pages.

Declines in spatial ability, general ability to manipulate images or patterns mentally, might contribute to older adults' difficulties navigating through the Internet systems (Shepard & Metzler, 1971). A normative decline in spatial abilities is associated with age (Salthouse, 1992). Older adults may have a poor ability to conceptualize the hierarchical structure of the web pages on the Internet. The decline in working memory and spatial ability may reduce the likelihood that older adults are able to find the information they seek on the Internet. When new information is encountered, it may be interpreted in the old context of the older adults' pre-existing knowledge base. Instructional materials should be presented using older adults' familiar terminology and pre-existing knowledge to facilitate learning (Pak, Rogers, & Stronge, 2000).

Technology Acceptance Model (TAM) and Theory of Reasoned Action (TRA)

TAM has been widely applied to studies of technology use. TAM was adapted from the well-known Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which is a framework used extensively for predicting and explaining a variety of human behavior. TRA specifies that causal linkages flow in a sequence from beliefs, attitudes, and

intention to behaviors. TAM, proposed by Davis, Bagozzi and Warshaw (1989) and shown in Figure 1, modified TRA to predict computer adoption by replacing the belief determinants of TRA with two key beliefs: PEU and PU. PU was the belief that use of a particular technology will improve one's performance. PEU was the belief that using technology will be effortless. Further, in the model of Davis et al., PEU directly affects PU, with both of the use beliefs affecting computer technology adoption. Davis et al. also suggested that external factors may be important determinants of the usefulness constructs of TAM, but they did not empirically test such factors at that time.

Davis' TAM

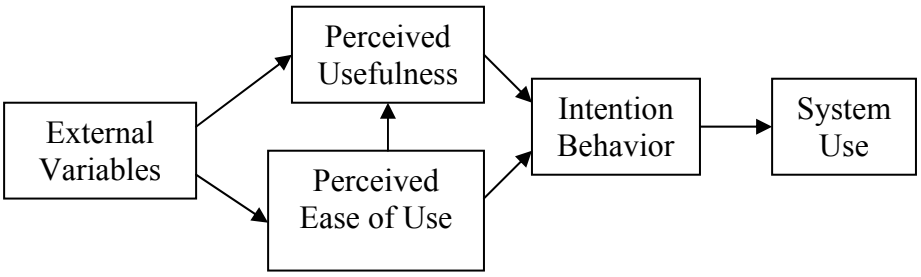

Figure 1: Davis' Technology Acceptance Model
Davis, F. 1993. User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. International Journal of Man Machine Studies.

Researchers have extended TAM by proposing and testing specific antecedents to its two use belief constructs. As explained by Mathieson (1991), without external factors, TAM provided only very general information on users' opinions about a system but did not yield "specific information that can better guide system development" (p. 173). For the senior site study, the researcher considered usability features prior to entering the modified TAM, JAM's SrHI-TAM, which included not only three core determinants of TAM, i.e. PEU, PU and SU, but the antecedents of and IR. One set of such antecedents involved the characteristics of the participants' self-efficacy, with the second set including outcome, i.e. short-term information retention through the use of a pre- and post-assessment.

Technology Acceptance Model (TAM)

The seminal works on TAM included Davis's doctoral dissertation, "A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory And Result" completed in 1986 at Massachusetts Institute of Technology. In 1989, Davis wrote "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," which was published in MIS Quarterly. Davis then collaborated with Bagozzi and Warshaw, P. R. in writing "User Acceptance of Computer Technology: a Comparison of Two Theoretical Models," which was published in Management Science during 1989.

Davis's TAM provided a basis for the tool used to analyze senior health information on the Internet, U, and RI, i.e. JAM's SrHI-TAM. The following two models illustrate Davis' basic model and the adaptation of that model to this study, as shown in Figure 2 and 3.

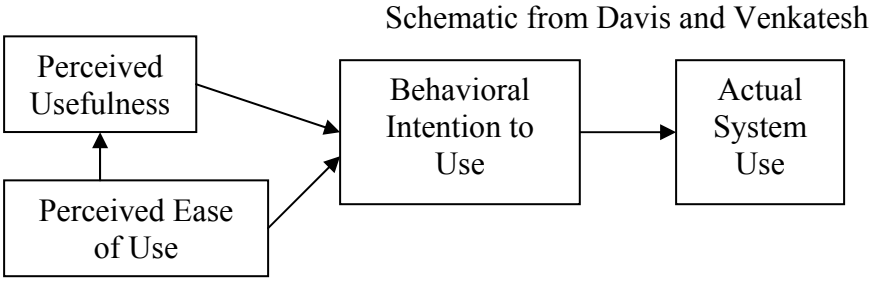

Figure 2: Diagram/Schematic from Davis (1989), Venkatesh, Morris, Davis, G., & Davis, F. (2003)

JAM's SrHI-TAM

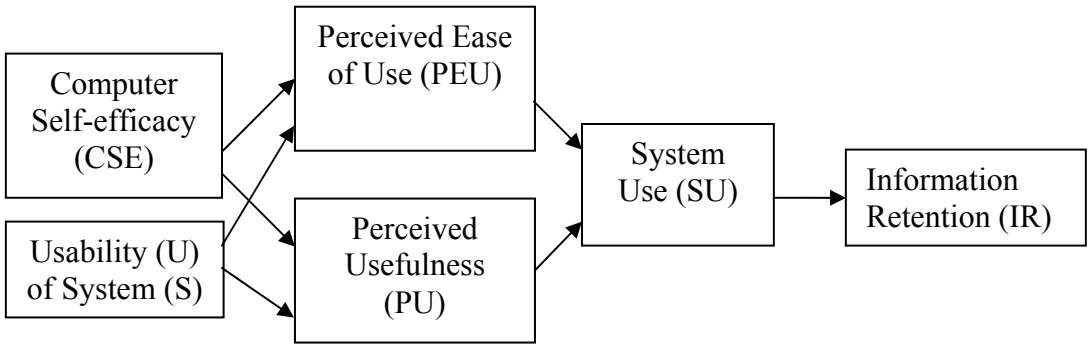

Figure 3: JAM's Modified Technology Acceptance Model (SrHI-TAM)
Modified from Davis, F. 1993. User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. International Journal of Man Machine Studies.

System Characteristics

Since TAM was proposed by Davis in 1986, system characteristics have been posited to directly affect user beliefs. Subsequent research has validated the role of system characteristics in predicting user beliefs and technology acceptance in other contexts (Davis, 1993; Igbria, Guimaraes, & Davis, 1995; Lucas & Spitler, 1999; Venkatesh & Davis, 1996). A variety of general information technology system characteristics have been proposed and examined. For this study, three sets of characteristics were selected that are considered to be critical for the development of systems. The first of the system's external characteristics, usability, refers to the incorporation of design elements for ease of accessing and ease of information search (Park, 2004). Usability addresses the design and development can help the user use the system effectively. Furthermore, usability has a subset of five characteristics according to Seels and Glasgow (1998) and Selim (2003). For usability, the subset included the content of the web pages which should be (1) formatted; (2) displayed so users can easily see or access the

important sections; (3) provided navigable tool aids; and (4) offered feedback. The user interface must provide appropriate feedback to the users for reinforcement and better understanding content. Finally, the website should demonstrate (5) consistency through sequences of actions, labeling of links and buttons, and navigation format. To make certain these characteristics met the need of the targeted users, the perceived ability of a system that provided flexible access (Seels & Glasgow, 1998; Selim, 2003) was tested by HFPs and the senior participants. Without proper presentation, the system will not be used, which is the third system characteristic examined. Kerka (1999) indicated that the potential advantages of a system are limited by design of content presentation, which can hamper the delivery and retention of information.

Computer Self-efficacy

A second set of external variables included in this study is individual attributes. Individual characteristics were included in the study for two reasons. First, it seems reasonable to assume that seniors may form different perceptions of a system due to individual attributes, and that such attributes may be related to technology usage. Heinich, Molenda, Russell and Smaldino (2001) assert that characteristics must be considered in order for technology to be used effectively. Second, in empirical studies, user characteristics have been found to impact behavioral intention to use technology (Davis, Bagozzi, & Warshaw, 1989). In application, the user's success has been found to depend on the ability to cope with technical difficulty and technical skills in computer operation and Internet navigation (Kerka, 1999). Therefore, in this study, CSE and Internet experience are posited as two factors that are expected to influence SU and IR.

Self-efficacy, the first user characteristic, reflects one's beliefs about the ability to perform certain tasks successfully (Bandura, 1977). Further, computer self-efficacy has been defined to reflect one's beliefs about the ability to use computers effectively (Compeau & Higgins, 1995b). Prior research has indicated that self-efficacy influences performance or behavior (Compeau & Higgins, 1995a; Compeau, Higgins, & Huff, 1999; Taylor & Todd, 1995a, 1995b), including behavioral intention (Tan & Teo, 2000; Venkatesh, 1999), and other studies have found that CSE and PEU are related (Davis, 1989b; Venkatesh & Davis, 1996). Further, Lim (2000) found that CSE influences participation of adults in SU and understanding and retention of information, i.e. IR.

The second individual attribute included in this study is Internet experience. Based on related research, a learner's prior technical skills in using the Internet may affect use. For example, prior computer experience has been found to influence intent to use a variety of technology applications including Internet services (Igbaria, Guimaraes, & Davis, 1995; Tan & Teo, 2000).

Ease of Use and Usefulness (PEU and PU)

Davis posited that two belief dimensions, PEU and PU, impact intention to use technology. These belief constructs are central to TAM and routinely included in technology acceptance studies. PEU and PU are interlinked according to (Davis, 1989b).

Research results from Georgia Institute of Technology identified key PEU and PU problems. These included inability to find a page and information (Pitkow & Kehoe, 1996), use of language, terminology, relevance, navigability (Levi & Conrad, 1996; Lightner, Bose, &

Salvendy, 1996). In addition, accuracy, timeliness, completeness, and relevance are considered usefulness factors (Griffin, 1990).

Outcomes: SU and IR

As noted by Carswell and Venkatesh (2000), empirical studies testing TAM-like models typically examine intention to use the technology application being studied and obtain user perceptions of the beneficial characteristics of the system. Further, given the resources invested in systems, it seems reasonable that those making the investment decision would want to know if seniors intend to use such systems both for supplementary information and for information retention along with the factors that predict such intent.

In nearly all TAM studies, a single intention construct is used. One reason for this may be that TAM features one outcome. A second possible reason is that many studies examine technologies that have a general purpose (e.g., e-mail, word processing) and accordingly employ an outcome designed to reflect this general use (Sen, 2005). However, in a study of health information for seniors, behavioral intention was categorized into "intended inquiry" and "information retention," reflecting two distinct purposes of information (Gefen & Straub, 2000). Likewise, in this study, to reflect two specific purposes of the HI system under study, behavioral intention (SU) is directed into use for supplementary information and use for information retention, IR.

Research Models

This model posits that U and CSE, including Internet experience, affect both use belief constructs, i.e. PEU and PU. Further, the impact of the antecedent variables on usage is hypothesized to be entirely through, or completely mediated by, PEU and PU. Thus, this model

is a fully mediated model (Sen, 2005). This specification is taken from TAM, and has been empirically supported by other studies (e.g., Agarwal & Prasad, 1999; Davis, 1993; Igbaria et al, 1997). Also taken from Davis' TAM, PEU will directly affect PU, and both of the use beliefs will impact the use outcomes. Finally, the model posits that use of the system for supplementary learning purposes will directly affect use of the system for information retention. The positive relationship required that the health information system had features specifically designed to support both reference and IR of seniors. The presence of such features suggested that system characteristics played a more important role in influencing the outcome than this model implies.

JAM's SrHI-TAM differs from the previous models. First, usability and system functionality is hypothesized to have a direct effect on use of the system for information retention purposes. Specifically, seniors who perceive that the system effectively provides them with access to HI content at a time and place of their choosing will be more likely to use the system for information. The primary reason, the researcher believes, for the effect is that such a system will be perceived as being compatible with senior needs for flexibility of access and value to receive quality information.

Compatibility is often thought to underlie technology acceptance (Davis et al, 1989; Moore & Benbasat, 1991). It has been found to predict senior intent to use a system for accessing HI (Carswell & Venkatesh, 2002).

As cited above, whereas some researchers have found that these beliefs fully mediate the relationships between external factors and technology use, other researchers have found direct effects between such external factors and technology use (Igbaria et al., 1995; Jackson, Chow, & Leitch, 1997).

Accordingly, the overarching hypothesis for the research model, i.e. Figure 3, was that the Internet HI website's usability ratings by HFP and senior users correlate to IR levels. Positive usability ratings relate positively to PEU, PU, SU, and IR. The hypothesis is there is a positive relationship between a website assigned high usability ratings by experts and senior users result in positive content retention by seniors. This involves testing four hypotheses and two sub-hypotheses. The general and specific study hypotheses were:

H_1: Usability (U) ratings of the system (S) by HFPs are consistent with senior participants' ratings of U.

H_2: System (S) HI website's usability (U) ratings by Human Factor Professionals (HFP) and senior users and computer self-efficacy (CSE) predict Information Retention (IRO) levels, through other determinants in the model.

H_3: Perceived ease of use (PEU) and perceived usefulness (PU) are positively affected by usability (U) and computer self-efficacy (CSE).

H_4: System usage (SU) for information retention (IR) purposes is positively affected by perceived ease of use (PEU), perceived usefulness (PU) and, that is through other determinants in the model.

$SubH_1$: IRO is positively affected by SU,

$SubH_2$: IRP (pre-assessment) score improved on IRO (post-assessment)

These hypotheses were tailored from Davis's TAM research of 1991 (Davis, 1993).

Operationalization Of Key Terms

Davis's Technology Acceptance Model (TAM)

TAM was an adaptation of the TRA to the field of information systems (IS). TAM posits that PU and PEU determine an individual's intention to use a system with intention to use serving as a mediator of actual system use. PU is also seen as being directly impacted by PEU. Researchers have simplified TAM by removing the attitude construct found in TRA from the current specification (Venkatesh, Morris, Davis, G. & Davis, F., 2003). Attempts to extend TAM have generally taken one of three approaches: by introducing factors from related models, by introducing additional or alternative belief factors, and by examining antecedents and moderators of PU and PEU (Wixom & Todd, 2005). TRA and TAM had strong behavioral elements and assumed that an intention to act would result in an act without limitation; however, there are constraints, i.e. limited ability, time, environment, and organization. TAM, initially a model to test acceptance by users of management information systems, is based on the TRA, which emphasized the importance of the determinants' consciously intended behaviors (Fishbein & Ajzen, 1975). TAM was developed to understand and predict an IS acceptance behavior and was used to analyze how technology was perceived and its usage and the resulting user attitude toward using the system (Stefl-Mabry, 1999). TAM embellished TRA with two sets of constructs: PU and utility plus attitude and intention to use the IS and actual usage. User acceptance of a system can be predicted by TAM's PU and PEU; however actual usage may not be a direct or immediate consequence of such attitudes and intentions (Bagozzi, Davis & Warshaw, 1992). Earlier research suggested the prominent determinant of system adoption is

PEU. Tornatzky & Klein (1982) found that compatibility, relative advantage, and complexity had the most significant relationships with adoption.

The augmented TAM, SrHI-TAM, to be used for seniors' technology acceptance and IR is a conceptual framework that included a unique system, nihseniorhealth.gov; with components CSE, PEU, PU, SU and the outcome of IR on the specific topic of colorectal cancer.

Seniors

People age 50 and older now constitute the fastest growing group of computer users and information seekers on the World Wide Web (US Department of Commerce, 1999). Seniors go online principally to find health information, travel details, and for personal correspondence (Morrell, Mayhorn, & Bennett, 2000). For purposes of the SrHI research, the author focused on participants age 50 and older. This is the age that physical changes may be observed and screening begins for colorectal cancer. Fifty is the age that AARP seeks senior members.

System (S)

The system, a senior friendly website, www.nihseniorhealth.gov, was developed in accordance with guidelines from "Making your Web Site Senior Friendly" (National Institute on Aging and the National Library of Medicine, 2002a). The site was jointly developed by NIA and NLM (National et al, 2002a). The system includes external variables of U and CSE.

Usability (U)

For the purposes of this study, the term usability is meant to be the foundation, i.e. the design and development of a system. Of course, prior to design and development, ease of use and usefulness must be considered, but these are in preparation to create a system appropriate to the

audience. There is a fine distinction between the historical definitions and descriptions that follow.

Research in human computer interactions has prompted usability studies. Typically, the focus has been on collecting data about websites, their accessibility, frequency of visits, and frequency of use of each hyperlink. Nielsen (1993), an expert on web usability, defines usability as "the measure of the quality of the user experience when interacting with something—whether a website, a traditional software application, or any other device the user can operate in some way or another" (p.3).

Nielsen (1993) stated usability applies to all the aspects of a web site that a user might interact. Usability is the degree to which a user believes the experience is free of effort (Vijayasarathy, 2004) and information detailing their features and performance from the website. Therefore, the model incorporates ease of accessing and ease of information search (Park, 2004). Usability addresses whether or not the user can use the system effectively due to the design of the system. For seniors, a usability consideration is that the website should be designed to accommodate degradations in working memory. Learners can misinterpret or misread information being presented due to a lack of contextual cues (Barnard, 1997).

The SrHI study considered features of usability according to NIA (2002a); Park (2004); Seels & Glasgow (1998); Selim (2003); Nielsen (1993); Nielsen & Tahir (2002); Hollis-Sawyer & Sterns (1999). The recommendations were compared on Table 1: Survey Characteristics to Consider for Usability and synthesized to develop the features considered under JAM's SrHI study, which is the last column on the table. Both the HFPs and the participants considered these features in the usability assessment.

Table 1: Survey Characteristics to Consider for Usability Design and Development

Source / Guideline	**NIA (2002a) Hodes & Lindberg, (2004)**	**Park (2004); Seels & Glasgow (1998); Selim (2003)**	**Nielsen & Tahir (2002)**	**Hollis-Sawyer & Sterns (1999)**	**JAM's SrHi indices used in pre- and post-assessments**
		Access			
	Background				
	Color				
	Consistent				
					Favorites (add into)
		Feedback			
		Format			
			Graphics		Graphics clear and easy to see
	Icon style and size				Icons effective
					Ideal Site
					Information relevant
	Information	Information Search			
					Information useful
	Justification			Instructions to complete tasks	
					Language easy to understand
	Layout				Layout logical
	Menus				
	Navigation	Navigation			
	Organization				
					Prompts clear
					Recommend

Source / Guideline	Hodes & Lindberg, 2004	Park, 2004; Seels & Glasgow, 1998; Selim, 2003	Nielsen & Tahir, 2002	Hollis-Sawyer & Sterns, 1999	JAM's SrHi indices used in pre- and post-assessments
					Return visit desired
		Sections			
	Simplicity				
	Spacing			Spacing	
				Supplemental Materials	
			Targeted audience		
	Text typeface		Text, Larger	Text, larger	Text easy to see and read
	Text type size			Text, double-spaced	
	Text weight				
	Text Capital and Lowercase				
					Titles Clear
					Useful
	Writing style				
			User Friendly		User Friendly

Self-Efficacy / Computer Self-efficacy (CSE)

Self-efficacy is a reflection of one's beliefs about the ability to perform certain tasks successfully (Bandura, 1977). Computer self-efficacy has been defined to reflect one's beliefs about the ability to use computers effectively (Compeau & Higgins, 1995b). Self-efficacy, as defined by Bandura (1997), is "the belief in one's capabilities to organize and execute the courses of action required to produce give attainments" (p. 3). CSE is associated with positive attitude had a significant positive impact on intention to use (Gong, Xu, & Yu, 2004).

Perceived Ease of Use (PEU)

The definition of perceived ease of use is without difficulty or great effort. Davis (1989a) referred to it as the degree to which a person believes that using a particular system would be free of effort. The participants used a Likert rating system to assess the PEU of the nihseniorhealth.gov site.

Perceived Usefulness of the System (PU)

Usefulness asked whether or not the system does anything that the user cares about. PU is the degree to which a user believes that using the website would provide access to useful information. Useful value was how the task relates to future goals (Pintrich & Schunk, 1996). It had instrumentality and utility. Usefulness is a more external or extrinsic reason for engaging in a task. Eccles and Wigfield (1995) have provided correlational evidence that an individual's interest, importance, and utility for a task will affect task choice. Davis (1989a) defined it as the degree to which a person believes that using a particular system would enhance their performance.

System Use (SU)

The system usage is based on the forecast, potential use, and participant recommended usage to others.

Information Retention (IR)

In the SrHI-TAM the outcome of the HI system under study, information retention was assessed based on colorectal cancer content in a pre- and post-assessment. The IR measurement is based on information the participant acquired from the website and retained, which was verified by comparing the pre- and post-assessment. The post-assessment correct responses minus pre-assessment correct responses divided by the number of incorrect responses on the pre-assessment provided the data for the IR. The content was similar for both assessment instruments. New correct responses on the post-assessment will assume IR due to navigation of the site, with consideration for the SrHI-TAM components. Statistical procedures using SPSS 15.0 were run also.

Guidelines for Usability Assessment

A checklist was developed by Hodes & Lindberg (2004), directors of the NIA and NML respectively, to help accommodate seniors' access HI on the Internet. The list was research based and addresses the needs of senior Internet users, which now constitute the fastest growing group of computer users and information seekers on the World Wide Web (US Dept. of Commerce, 1999). They go online principally to find health information, to plan personal travel, and for e-mail (Morrell et al., 2000). While advanced age is not a hindrance to Internet use, there are normal, gradual age-associated declines in vision and certain cognitive abilities that may limit the use of electronic technology. In the last two decades, the NIA has funded a number of basic

and applied cognitive aging studies, focus groups, and usability tests, and survey research projects on how age-associated changes affect computer use (Charness & Bosman, 1990).

Changes in vision that occur with age can make it more difficult to read a computer screen. These include reductions in the amount of light that reaches the retina, loss of contrast sensitivity, and loss of the ability to detect fine details. Use of a standard page design and the same symbols and icons throughout will improve readability of online text. Additionally, seeking unbiased comments from older adults through focus groups is helpful. And, usability testing or other means aids the evaluation of accessibility and friendliness of the website (Hodes & Lindberg, 2004). Hollis-Sawyer and Sterns (1999) concluded that older adults, as well as younger adults, benefit from websites that provide the following characteristics: larger text, text double-spaced, instructions to complete tasks, and supplemental videos demonstrating how to complete the task.

Guidelines from the National Institute on Aging "Making a Web Site Senior-friendly" (Hode & Lindberg, 2004); Park (2004), Seels & Glasgow (1998), and Selim, (2003); Nielsen and Tahir's (2002) "Home Page Formats;" and Hollis-Sawyer & Stern (1999) resources were compared and extended before being collapsed to provide topics to develop the assessment tool for the Human Factor Professionals. The participants used a similar instrument in the senior questionnaire.

Summary

The study investigated a relationship between PU, PEU, SU, and IR in the SrHI-TAM system. Usability of the system and CSE of the participants were inherent variables within the site. These needed to be assessed as they were part of the hypotheses.

Because the topic is inter-disciplinary, it draws attention and expertise from several domains. The literature review is comprised of works from theorists; researchers; experts on aging, technology, and systems; and government organizations, that revealed differences in cognitive and psychomotor skills resulting in unique requirements for a senior health information websites. The eclectic combination of the topics contributed to the investigator's curiosity by expanding the research to include IR. Two inherent characteristics of the system and participants were usability and computer self-efficacy. The researcher looked at PEU, PU, SU, and IR. Each of the terms was reviewed in literature and was operationalized specifically to the study. To further the research, the investigator utilized the methods, procedures, and instruments included in Chapter 3, Methodology.

CHAPTER 3: METHODOLOGY

Introduction

Two groups were surveyed. One group consisted of four usability experts, Human Factors Professionals (HFPs), who had a minimum of six years experience as professional designers. The HFPs responded to a questionnaire that reviewed usability (U) of the health information Internet site. The second group consisted of senior adults 50 and older. The seniors were asked to complete a pre-assessment prior to accessing the health information site. This provided the baseline data for the group. After the pre-assessment was completed, the senior participants received instructions to access the designated site. The navigation was not timed due to the diverse level of cognitive and physical skills of senior adults. After navigating the senior site, participants were asked to complete a post-assessment. Quantitative methods were used to compare pre- and post-assessment responses, which identified prior knowledge and specific knowledge gained. The professionals' usability assessment of the site was compared to the users' assessment. The senior participants were asked to provide demographics that were used to identify patterns related to performance. The senior participants were from the University of Central Florida LIFE group, the Central Computer Society, Red Hatters, churches, and senior residential communities. QuestionPro, a firm specializing in research and identifying and surveying specific populations, served as the administrator. The research was be used to determine the relationships existing between usability (U), computer self-efficacy (CSE), perceived ease of use (PEU), perceived usefulness (PU), actual use and projected use and referrals, i.e. system use (SU) and information retention (IR). There was no manipulation of the variables, as the investigation was focused on the extent to which the variables were related. The

strength and direction of the relation was described by means of a quantitative index to clarify relationships and patterns among the variables. Statistical analysis, i.e. multiple regression, was used.

The research was a formative study. The study helped describe the variables, which were incorporated in the modified version of Davis's Technology Acceptance Model (TAM). That model was Madsen's Senior Health Information Technology Acceptance Model (JAM's SrHI-TAM), which encompassed the system (S) through user performance, i.e. IR, Figure 3.

There were no anticipated risks. No compensation or other direct benefits were available. Participants were free to withdraw and discontinue participation at any time without consequences. Participant responses were analyzed and reported anonymously to protect their privacy. The participant information collected was kept on a secured server and was password protected. Physical documents collected were filed in a locked secure file, accessible only to the principal investigator.

Study of Population and Sample Selection

The study was composed of two distinct groups to relate U, CSE, PEU, PU, SU, and content retention from a health information website to user information retention, IR. One group was comprised of four (HFP) who reviewed the website for design and U. The professionals responded to a two-page 30 item assessment. The other group was comprised of seniors. A prerequisite to participate was computer knowledge and prior use of the Internet. The senior adult group was selected for the study because the population is increasing and seniors have a unique interest in health issues (Ellis & Kurniawan, 2000), but the plethora of literature on CSE, PEU, PU, SU, and outcome has focused on younger groups.

A disinterested third party research firm completed a pilot test to identify participants. After the test, the company representatives indicated concern with the sampling and rate of return. The researcher then sought participants through several organizations and individuals, which included senior communities and groups, and computer organizations. The assessments were developed by the researcher based on previously validated instruments and were approved by the Institution Review Board at the University of Central Florida (UCF). Each senior participant accessed the pre-determined health information website, nihseniorhealth.gov, to rate U, CSE, PEU, PU, SU and IR by rating the ease of access and utility relative to user performance, i.e. new content retention responding to a forty-eight item assessment. The senior group had a pre-assessment before accessing the Internet website and a post-assessment after browsing the website. The instruments identified prior knowledge of content and newly retained content, and measurements of endogenous variables. The senior participants received a three-part questionnaire administered through QuestionPro, the firm specializing in surveys. Copies of the invitation, instructions, and questionnaires can be found in the Appendix A. The formative study included enough participants to ensure that sufficient data was collected to allow in-depth analyses, and so that confident inferences could be drawn from the data as recommended by Hair, Anderson, Tatham, and Black (1998).

The criteria for selecting the health information website were based on a previous study for usability and accommodations for the senior audience. The deciding factors for the website selection were: credibility, orientation to senior adults, frequently cited website by other websites, and inclusion of health topics relevant to older adults (Nahm, et al., 2004). The senior health information website selected was the NIH Senior Health Information site. Though this website provided information on various topics of interests to seniors, the evaluation was limited

to the health information section with emphasis on colorectal cancer. The topic of colorectal cancer was selected as the agent as it is the second-leading cause of death from cancer in the United States. The risk of developing colorectal cancer increases after age 50, consequently, early detection in adults begins at that age. It has been common in both men and women and is up to 90 percent curable (NIH, 2006). Colorectal cancer was a topic that many seniors found of interest because physicians recommend screening to begin at age 50 (NIH, 2005).

User Knowledge Retention Section

The senior group had a pre-assessment before accessing the Internet website and a post-assessment after following instructions to browse the website. This instrument identified prior knowledge of content and newly acquired knowledge. In addition, it measured PEU, PU, and IR.

Methods

Participants and Procedure

The four HFPs were professionals recruited from local Orlando, Florida organizations. Each had a minimum of six years of design and usability experience. They were professionals, who had taken graduate courses through UCF, and were known to the investigator as professional colleagues. The usability experts received a Letter of Informed Consent to read and if they were willing to participate, they signed the copy that is kept on file. A second copy was provided to the HFP for his/her records. A copy of the letter along with the questionnaire protocol and sample instrument is included with the IRB application, Appendix A.

Senior participants of the online sample questionnaires were pre-screened by ERI, who maintained the confidential information. They received a copy of the consent form through

QuestionPro. The participants included in the data collection were senior adults age 50 and older who possessed basic Internet literacy. All were Internet users. Findings are available to all participants, HFPs, and seniors, if desired. The senior surveys were administered through QuestionPro software in collaboration with eRewards (ERI). Both corporations are research firms specializing in surveys. ERI maintained a database of over 1.5 million panelists. For the sample test, the original participants were pre-screened and selected from the database maintained by ERI. ERI collected and maintained the confidential information.

Participation in the study was voluntary. Of 392 contacts, 234 (59.7%) viewed the introduction and 145 seniors started the survey with 68 completing all three sections. The researcher used Dillman's (2000) recommendations to reach latent participants The individuals original contacts were made via group presentations, organization postings and newsletters, personal contact and email. The second contact was an email, thank you agreement, survey, or follow-up request. The third contact was an email, thank you agreement, survey, re-sent survey, phone follow-up, or follow-up through referral contact. The fourth contact was the survey, re-sent survey, phone contact, or follow-up through referral contact. The fifth contact was a re-sent survey, phone contact, or follow-up through referral contact. Additional contacts were made with participants who had questions or concerns. According to qualitative responses there were several reasons for the attrition. These are listed in the results in Chapter 4.

Given the seniors' interests in the Internet and health, the researcher believed seniors, as a whole, represented those who would be interested in using the Internet for accessing and retaining health information. The selected site, nihseniorhealth.gov, is on the World Wide Web and is accessible to other groups. The assessment was not timed, as seniors possess diverse skills and processing abilities but the participants took 5 to 45 minutes to process and complete the

questionnaires. The average time taken to complete the questionnaires in the survey was 14 minutes.

Data Collection and Treatment

Three instruments were used to collect data. The first instrument, a usability questionnaire, in Appendix B, was completed by the four usability experts. The 30-item questionnaire incorporated the Likert scale with 5 degrees per item for 26 questions. Three of the questions were open-ended and one question was a yes/no question. The design indices included consistency, presentation, chunking, colors, graphics, icons, information, language, layout, navigation, and text. According to Charness, Kelley, Bosman, and Mottram (2001) these navigational features must be considered when designing a website for older adults. The organization of the website should be simple and straightforward according to the Nielsen Norman Group (2006).

The second instrument with results in Appendix C was administered to the senior population. It measured CSE, as well as provided a pre-assessment for information presented on the website. The pre-assessment was compared to the post-assessment. The purpose of the comparative assessments was to identify prior information versus newly acquired, retained information. The post-assessment asked similar content questions to compare with prior knowledge, new information retention, satisfaction with the website, and demographic information for each respondent. The validated questionnaire consisted of 28-scaled questions plus three demographic questions. A five-point Likert scale was used to measure indices proposed by Davis (1986). The information content and retention sections had 16 questions with three choices each. The information content assessment tool was adapted to measure user pre-

knowledge and post-retention. The assessments were derived from five validated instruments in the following studies: The effects of age, computer self-efficacy, and the design of web-based training on computer task performance (Artis, 2005); the impact of self-efficacy and task value on satisfaction and performance in a web-based course (Lee, 2002); "FORE NIH Survey" (NIH, 2006); "Usability Evaluation of Kodak EasyShare Photo System" (Evans, Glenn, & Savage, 2005); and "A Consumer-Based Assessment Of Alliance Performance: An Examination Of Consumer Value, Satisfaction And Post-Purchase Behavior" (Mouri, 2005).

The usability experts accessed the selected site. Each completed a paper document. The responses were manually entered into Excel. SPSS 15.0 and QuestionPro software was used to process the data gathered. The senior participants were recruited through various senior and computer organizations and QuestionPro administered the survey. The vendor was selected based on ability to provide an Internet site for a pre-assessment, redirection to the selected HI site, and a post-assessment.

Question Pro

QuestionPro provides a software solution with a dedicated portal to access the account. The software, an easy-to-use wizard interface, was used by the author to deploy the web-based survey. The service does include a comprehensive suite of tools for analytical data analysis (QuestionPro, 2006). Due to the complexity of the project, the pre-assessment, redirection to the selected HI site, and a post-assessment, the account was upgraded to a corporate license. A few of the referral organizations that had used QuestionPro included the School of Public Affairs, Baruch College, CUNY; Health, Senior Health Information, ING Advisor's Network; Summit

Publishing; Woelfel Research, Inc., State University of New York at Albany; Washington State, King County Library System; Safeway; and Fairfield Language Technologies.

Statistical Treatment

This was a quantitative descriptive study which followed guidelines from "Identifying Research Designs and Statistical Procedures" created by Dr. Stephen Sivo, UCF, to direct the design and process, and to analyze the data. Repeated Measures Analysis of Variance (ANOVA) was used to analyze the data since the research included pre-assessments and post-assessments. Regression was used to analyze the variables and their relationships.

The hard-copy data is stored in a file secured by the primary investigator. Validated questionnaires were used to measure the hypothetical model, which was tested for focus on technology acceptance, which contained CSE, PEU, PU, and IR as the outcome variable. The following seven indices were used in the data collection questionnaire: (1) U section, (2) CSE section and attitude section, (3) PEU section, (4) PU section, (5) SU section, (6) IR section and (7) Demographic section. The questions are in Appendix C.

U Section

Prior to beginning the senior participants' assessment, the HFPs assessed the U of the nihseniorhealth site. The seniors' assessed the site during their post-assessment phase. The U assessment consisted of 27 items for the HFPs and five items for the seniors. Each statement was rated on a five-point Likert scale to elicit the HFP and senior participants' opinion about the site's usability. The questionnaire is included in Appendix B.

The professionals were provided a two-page questionnaire with 30 questions/statements to rate the usability. The questionnaires were completed as the website was reviewed and

critiqued for usability. Previously validated guidelines were the basis for the assessment tool (National Institute on Aging, 2002b). A five-point Likert scale was used. The investigator retrieved the paper questionnaires upon completion.

References and guidelines to measure usability factors were adapted from previously developed measures. These included the works of Hode & Lindberg, (2004), Park (2004), Seels & Glasgow (1998), Selim (2003), and Nielsen and Tahir (2002), with developed lists, and NIA (2002a) with identified principles of design for seniors, and Hollis-Sawyer and Stern (1999) guidelines. The investigator combined usability features from different sources and collapsed the criterion to yield 13 items for the senior questionnaire: appropriate and clear title, adapted font/text size, clear graphics with color and contrasts, easily comprehended text, clear prompts and effective icons, logical layout and presentation consistency, site usability, useful content, and user friendly navigation and hyperlinks.

The HFPs' assessment required professional expertise to measure the actual usability of the website. While the seniors' Use instruments measure two constructs: senior adults' assessment of usability of the site and senior adults' PEU of the site. The variables are in Appendix B and C.

CSE Section

The seniors' self-efficacy and attitude assessment consisted of 11 items. The statements were rated on a five-point Likert scale to measure the participant's Internet CSE. These are included in Appendix C.

PEU Section

The seniors' PEU instrument measures ease of use. According to Davis (1986), the PEU exerts a causal influence on PU and both affected users' attitudes toward use. Participants were asked to respond based on their perception about how easy the site was to use. The variables were measured on a five-point Likert scale and are in Appendix C.

A tailored questionnaire, which was validated from previous studies, was provided the senior participants to assess the individuals' PEU and PU, CSE, SU of the health information website and user performance, IR. The instruments were completed prior to website access and after use. The tools were Internet-based and generated results immediately after completion or termination. The specific subject matter was limited to colorectal cancer, because this was a health issue that most seniors have assessed regularly, and as Nahm et al. (2004) suggest the website should include health topics relevant to older adults.

PU Section

The perceived usefulness instrument consisted of six items to measure how useful the information of the senior health information website is to the seniors. The value of the website to the individual is PU. Relative to usefulness is system use, which is covered in the next section.

SU Section

Use of the system had self-report scales that were measured on a five-point measure. Senior adults were being asked to select one of five options to match their use of the Internet health information site. The statements focused on seniors' potential return visits to the site and storage of the site in the "Favorites" tool on the toolbar. In addition, the research asked about

recommendations of the website to other senior Internet users. This section measured the system use, potential use, and recommendations to others for use.

IR Section

The senior group had a pre-assessment before accessing the NIH senior site and a post-assessment after following instruction to browse the website. This instrument identified prior knowledge of content and newly acquired knowledge. This measured PEU, PU, and IR. The information retention was measured on a three-point scale. Seniors participants' answers in the pre-assessment were compared to responses in the post-assessment. With an increase in the number of correct content responses from the pre-assessment to the post-assessment, there is an increase in the content retention. This was based on the operationalization of the IR term for this study.

Data Collection Procedures

The content section of the questionnaires data was tabulated for each category and processed through SPSS (2005) and by Question Pro for overall scores. Both the HFP and the seniors' data were processed for usability. CSE was assessed. PEU and PU were analyzed to provide the seniors' PEU and PU of nihseniorhealth. An additional section of the questionnaire assessed SU, potential use, and referrals to others to use. These variables led to the outcome, IR by senior participants and their related performance. The HFP experts' data were stored in a secured location by the investigator, so follow-up may be completed, if necessary. The senior participants' results were coded and stored by the administrator in a secured system. Demographic data was collected and processed for potential trends and may be valuable in future studies.

Potential organizations and participants were identified. These included senior and computer organizations, educational and public institutions, and senior communities. Though these were considered, the negative aspects of data collection included a limited number of participants at each website, numerous incidences of administration, extensive travel, extended schedule commitments, and unsponsored funding. Considering these drawbacks, the most efficient process to reach technology savvy seniors appeared to be contracting through a research firm offering special rates to graduate participants.

The investigator performed the assessment development and analysis of the data findings. The questionnaires were retrieved from the four HFP experts, so the assessments could be used to rate the website for usability. The level of usability was rated on a five-point Likert scale. Following the seniors pre- and post-assessments results, the HFP usability ratings were compared to the seniors' usability ratings. CSE, PEU, PU, SU, and information acquisition and retention ratings were collected.

Instruments

The survey instruments were developed to measure constructs primarily by adapting previously validated instruments to fit the senior health information system context. However, for the system characteristics, the researcher was able to locate previously validated items that matched the constructs of interest. Therefore, the assessments were based on features considered to be important for senior health information systems as cited in the literature review. The instruments were developed using questionnaire items from studies by Artis (2005), Evans et al. (2005), Lee (2002), Mouri (2005), and NIH (2006).

The study's instruments used a five-point Likert scale to assess seniors' agreement or disagreement for the items measuring PEU, PU, SU, and the outcome variable, IR. A similar five-point Likert scale was used to measure seniors' confidence level in using the technology as well as the extent to which the senior had previously used the Internet.

Some items were adapted to fit the senior health information context. QuestionPro pre-assessed the instrument on a small sample of individuals via ERI. Pretest feedback led to minor changes in some of the items. While senior perceptions varied, participants generally had favorable perceptions of the senior health information system characteristics (especially system functionality). The respondents had Internet experience and were generally confident in using the system. Positive views were expressed with respect to PEU and PU, and intended SU for supplementary information and retention purposes.

Data Collection

A tailored questionnaire, which was validated from previous studies, was provided the senior participants to assess the individuals' PEU and PU of the health information website and user performance, IR. The instruments were completed prior to website access and after navigation of the site. Also, the professionals were provided with a two-page questionnaire and asked to rate the U based on criterion established by a condensed version from other validated assessment tools. A five-point Likert scale was used and the questionnaires were completed as the website was reviewed and critiqued for U. The investigator retrieved the questionnaires. The participants' questionnaires were Internet-based and generated for a collection to be retrieved immediately through the website.

Data Analysis

Completion of the data analysis provided support for the collected data to confirm it was of adequate size and valid. The measurement and research models were tested by applying a multiple regression approach, using the computer software program of QuestionPro plus Statistical Package for the Social Sciences (SPSS). The sample size of 68 in this study was considered adequate for multiple regressions. This study used maximum likelihood estimation to obtain estimates of model parameters, and an R Squared level of .10 or higher and statistical significance of <.05 was used for statistical tests.

Anticipated Limitations of the Study

Anticipated limitations of the study are the senior users' Internet skills vary and may be limited, even though a prerequisite of participation was Internet usage skills. According to Eastman and Iyer (2005), despite the growth of the Internet, one area that has not been discussed is the use of the Internet by the elderly. Internet users over age 50 comprised the fastest growing demographic group in the U.S. Internet market (NUA, 2000). Given the rapid growth of this population as well as the potential the Internet held for them, it was a subject worth consideration (Eastman & Iyer, 2005). Moreover, individual physical and cognitive limitations differed. In addition, different types of computers, settings, and Internet services influence the perception by participants and impact the rating. Validity of the study relied on participants' honest responses to the questionnaires and individual responses without the help of other individuals. It was anticipated that the costs would be limited to the expense of the survey administration, which was administered through an online survey organization, QuestionPro; minor travel expenses;

replication of documents and manuscripts; and time and effort of dissertation committee members and the candidate.

For purposes of this study, seniors were considered to be those individuals 50 and older. This is a massive group. The reason for age of 50 was that materials in a senior site apply to individuals of that age. An example was the colorectal section that stated "individuals begin screening at age 50" (NIH, 2006). AARP, an organization for retired people, focused on individuals of age 50 and older. Additionally, numerous health issues surface at age 50. A few of the concerns are macular degeneration, osteoporosis, bone weakness, colorectal cancer, and cognitive and memory declines.

CHAPTER 4: RESULTS

Introduction

The purpose of this study was to investigate the effect of usability and computer self-efficacy and technology acceptance on seniors' information retention using a modified version of Davis' Technology Acceptance Model, i.e. JAM's SrHI-TAM. The usability (U) and computer self-efficacy (CSE) were added to the hypothetical model to better explain the seniors' attitude toward using technology for usage and information retention.

During 2006 and 2007, a total of 392 seniors were invited to participate in the survey designed for this study. Of the 392, 19 bounced and could not be contacted to complete the survey. This was the result of an incorrect email address or a block on delivery of the email. The survey was administered before and after the site visit to nihseniorhealth to see the incremental differences in variables toward the contribution to usage and information retention. Of the seniors contacted, there were 234 seniors who accessed the introduction and 145 seniors began the survey. Sixty-eight completed the three sections, i.e. the pre-assessment, the site visit, and the post-assessment. The responses of these 68 were used for the analysis. Seventy-seven dropped out after starting, for a completion rate of 46.9% of the 145 who began the survey.

The assessments were framed from five pre-validated instruments developed for studies by Artis (2005), Evans, et al. (2005), NIH Senior Health (2006), Lee (2002), and Mouri (2005). The data was processed using QuestionPro and SPSS 15.0 for Windows (2007) to provide the findings. Regression, ANOVA and correlations were compatible with the study and sample size and were used as the procedures to report the findings.

Reliability

The assessments were adapted from literature, but the investigator reaffirmed the reliability to a satisfactory degree. There were five scales used to measure U, CSE with AT, PEU, and PU. The CSE scale had five items plus six AT items; the U scale had eight items; the PEU scale had ten items; PU had six items; and SU had three items. The information retention (IRP) pre-assessment and (IRO) post-assessment had eight items each. The IR items were rated on three scales. Using SPSS for Windows the reliability of those five and three scale instruments was studied and is presented in the following table. The related assessment instruments are in Appendix C.

Table 2: Reliability Statistics for SrHI-TAM Variables

Reliability Statistics

Variable/s	Comment	Cronbach's Alpha	Number of Items	Items Deleted
Computer Self-Efficacy (CSE)		.220	5	
		.804	4	CSE5
plus Attitude (AT)	Not Included in model	.445	6	
		.507	5	AT6
		.601	4	AT5
		.765	3	AT2
Usability (U)		.936	8	
Perceived Ease of Use (PEU)		.934	10	PEU1 and 2
Perceived Usefulness (PU)		.873	6	
System Use (SU)		.369	3	
Information Retention Pre-test (IRP)		.779	8	
		.782	7	IRP1
Information Retention Post-test (IRO)		.837	8	

Participants ratings of computer self efficacy obtained from the CSE instrument were judged to be of poor reliability for the seniors to whom it was given, with a reliability coefficient of .220. When item CSE5 "I seem to waste a lot of time struggling with different websites to find information" was removed, the reliability of the scale increased to .804 which is a very good reliability. This is attributed to the CSE5 negative correlation with the total. AT items were

originally incorporated into the CSE variable; however three of six items were removed one at a time. Since AT contributed little to the analysis, the AT items were removed and were not a part of the model.

The participants ratings of usability of the system as obtained from the U instrument. The items were judged to be very reliable by the seniors completing the site usability section, with a reliability coefficient of .934. Participants ratings of perceived ease of use for the items PEU3 titles clear, PEU4 text easy to see, PEU5 easy to understand, PEU6 graphic clear, PEU7 layout logical, PEU8 icons effective, PEU 9 user friendly, and PEU 10 prompts clear were judged to be very reliable with a reliability coefficient of .934 as shown on Table 2. PEU items 1 and 2 were eliminated prior to processing as items 1 and 2 were related to the survey structure, and should not be considered variables.

Participants' ratings of perceived usefulness for the items PU1 relevant information, PU2 useful information, and PU3 ideal site were judged to be modestly reliable with a reliability coefficient of .695 as shown on Table 2. The three additional items of PU 4 will return to site, PU5 will say positive things about site, and PU6 will recommend site to others were added. With the six PU items the reliability increased to .873, a very good reliability as shown in Table 2.

The data was collected as the questionnaires were completed by participants from senior and computer organizations, educational and public institutions, and senior communities. Though these were considered, the negative aspects of the data collection included a limited number of participants at each website, numerous incidences of administration, extensive travel, extended schedule commitments, and unsponsored funding. Considering these drawbacks, the most efficient process to reach technology literate seniors appeared to be contracting through a research firm offering special rates to graduate student participants. This effort was less

productive than anticipated, but proved valuable in conducting a pilot study and testing the instruments and making revisions based on the feedback. The investigator returned to the original plan of contacting organizations with large senior populations. The data collection and processing yielded limited but valuable results. The dropout rate analysis provided by QuestionPro and qualitative data contributed explanations for attrition and the return rate.

Research Questions

There were six research questions and four sub-questions posed. These were consistent with the hypotheses and sub-hypotheses, which are incorporated with the responses to the research questions. The questions were:

- Is the usability rating by HFPs consistent with the rating by senior participants?
- Does the overall hypothesized model, JAM's SrHi –TAM, fit the data in predicting senior post-assessment information retention (IRO) based on usability (U) and computer self-efficacy (CSE) ratings of the system?
- Did the site usability contribute significantly to perceived ease of use (PEU) and perceived usefulness (PU)?
- Did the site computer self-efficacy contribute significantly to perceived ease of use (PEU) and perceived usefulness (PU)?
- Do PEU and PU contribute significantly to SU?
    - Is SU positively affected by PEU?
    - Is SU positively affected by PU?

- Does SU contribute significantly to information retention (IRO)?
    - Do the number of correct responses increase from the information retention pre-assessment (IRP) to information retention post-assessment (IRO)?
    - If so, is the change significant?

Research Question 1

Is the usability rating by HFPs consistent with the rating by senior participants?

The first research question was considered based on the findings from the HFPs' and senior users' usability ratings. The senior participants' ratings had to be reconfigured as the scale from one to five with the one rating conforming to suggest standards had to be reverse coded. This was done so both assessments were using the same numeric measurement standards.

The question related to H_1: Usability Ratings of the System by HFPs are consistent with senior participants' ratings. A multivariate GLM was run to determine whether seniors and HFPs differed in their ratings of the website's usability. This revealed a significant effect of group ($F_{8,57} = 2.279$, $p < .05$), seniors tended to rate the website more poorly than did HFPs ($\mu_{HFP}=1.72$, $SE_{HFP} =.30$ and $\mu_{Sen} = 1.45$, $SE_{Sen}=.06$). The supportive statistics are in Appendix E, Table 15 and 16. A follow-up pairwise comparison revealed near significant effects of groups for items U5 (Prompts) ($F_{1,64}=3.574$, $p = .063$) and U9 (Graphics) ($F_{1,64} = 3.279$, $p=.075$), no other items approached significance.

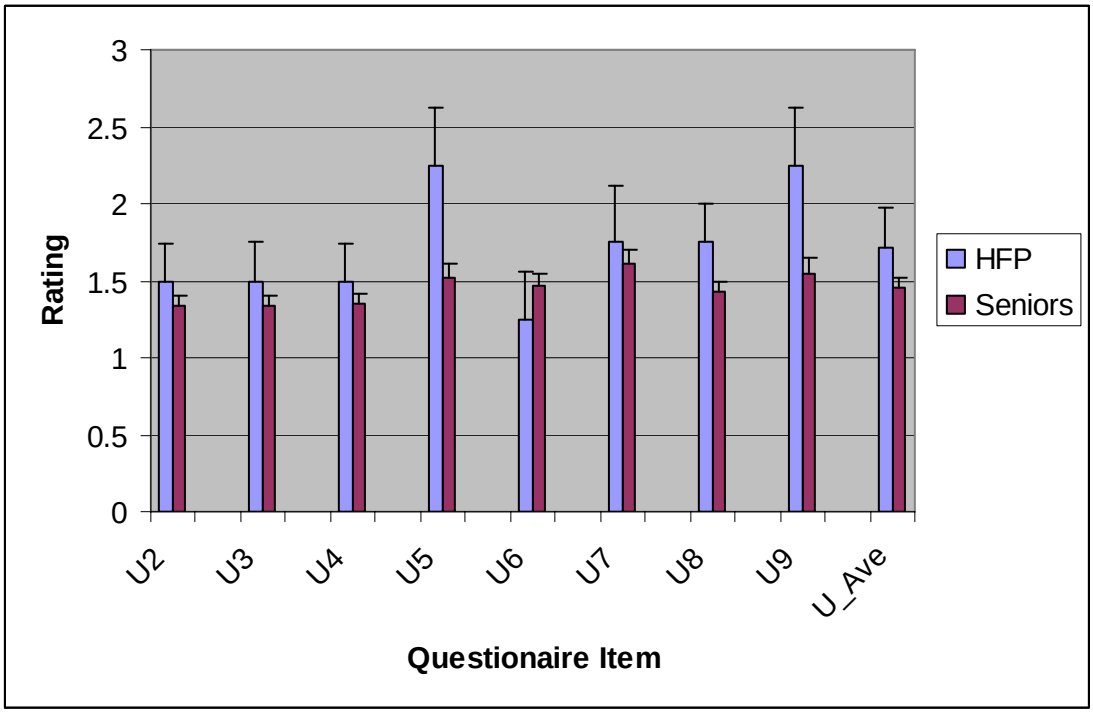

Figure 4: Usability Ratings by HFP and Seniors

Research Question 2

Does the the data support the overall hypothesized model, JAM's SrHi –TAM, in predicting senior IRO based on usability and computer self-efficacy ratings of the system?

A standard multiple regression was performed between Information Retention (IRO) as the dependent variable and Computer Self Efficacy (CSE) as the independent variable. Analysis was performed using SPSS regression for evaluation of assumptions. As shown in Table 3 there is a correlation between the variables, the unstandardized regression coefficients (B) and intercept, the standard regression coefficients (ß), R^2, and adjusted R^2. R for regression was significantly different from zero, $F(1, 57) = 7.23$, $p < 0.01$. CSE contributed significantly to IRO. Eleven percent (9.7% adjusted) of the variability in system use was predicted by knowing score on the independent variable; however, when SU was tested using Intent to Return and the Learning Index, no significant results were yielded.

Table 3: CSE / IRO

Variables	B	β	R^2	Adjusted R^2
IRO	1.220	0.336	0.113	0.097

Though the data does not support the overall hypothesized model; it should be recognized as a formative study. The findings should be challenged through additional research in a controlled environment with a larger population. This study provided interesting, unanticipated findings that enhanced the model. The findings included participants return to the site and recommendation of the site to others. Further exploration of the relationship of the constructs is encouraged.

Research Question 3 and 4

Did the site usability contribute significantly to perceived ease of use (PEU) and perceived usefulness (PU)? Did the site computer self-efficacy contribute significantly to perceived ease of use (PEU) and perceived usefulness (PU)?

For CSE proximities, the correlation matrix shows that CSE4 is negatively correlated with all items, which makes sense when looking at the actual question. In this case, CSE4 assesses a negative attitude while CSE1,3,5 assess positive attitudes. So in order to make them comparable, CSE4 was reverse coded. CSE2 also assesses a negative attitude, but is positively correlated, when it should show a similar pattern to CSE4. So items CSE1,3,5 were used.

For PU proximities, it seemed justified to split this into 2 blocks. The first (PU1,2,3) asked about the actual information on the website, block2 (PU4,5,6) asked about whether seniors will return, which actually fits better into System Use (SU). The correlation substantiated this.

The regressions for CSE and U show there is no relationship between those variables shown on Table 4.

Table 4: Regression: CSE - PEU

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	11.415	1.426		8.005	.000
	CSE	.025	.221	.015	.114	.910

a. Dependent Variable: U

The same pattern shows there is no relationship between CSE and PU, as shown on Table 5.

Table 5: Regression CSE - PU

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.057[a]	.003	-.013	3.82012

a. Predictors: (Constant), CSE

The fact that there is no relationship at all is actually rather interesting, though a null effect. The fact that self efficacy is irrelevant for both the PEU and PU is worth noting since it is counterintuitive.

Table 6: Regression PEU - PU

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.417[a]	.174	.160	3.85126

a. Predictors: (Constant), U

The third regression is closer to the hypothesis that U affects PU; there is a highly significant though not very strong relation between those variables.

Table 7: Regression U PU

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	187.615	1	187.615	12.649	.001[a]
	Residual	889.933	60	14.832		
	Total	1077.548	61			

a. Predictors: (Constant), U

b. Dependent Variable: PU

Research Question 5, 5a and b

Do PEU and PU contribute significantly to SU? Is SU positively affected by PEU? Is SU positively affected by PU?

A standard multiple regression was performed between System Use (SU) as the dependent variable and Perceived Ease of Use (PEU) and Perceived Usefulness (PU) as independent variables. Analysis was performed using SPSS REGRESSION for evaluation of assumptions. Both Perceived Ease of Use (PEU) and Perceived Usefulness (PU) contributed significantly to System Use (SU), PEU (R^2= 0.065) and PU (R^2=0.143). The two independent variables in combination contributed another .2 in shared variability. Together, 20% (18% adjusted) of the variability in system use was predicted by knowing scores on these two independent variables as in the following figure.

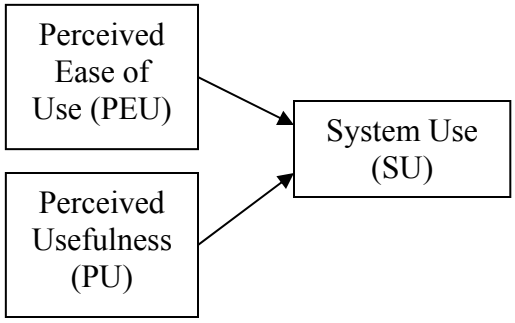

Figure 5: Perceived Ease of Use and Perceived Usefulness Contributed Significantly to System Usage

For the variable is SU, PU4 was a good indicator. PU4 is recoded as a will return / will not return dichotomy and called the new variable R, which resulted in a new model, JAM' SrHI-TAM2, Figure 5. Participants who agreed (1 or 2) that they'd return to the website was assigned a value of 1 and everyone who disagreed (4, 5) was assigned a 0. Those who had a 3 were not included in the analysis since they did not indicate whether they would return. And this graph demonstrates that seniors who rated the information as useful are highly likely to return while those who found the information less useful are not.

PU6 (whether they'd recommend the site to others) is recoded and the pattern came out even more clearly. One can predict with about 90% certainty whether they will recommend the site based on how useful they thought the information was. Then, the fourth and the fifth items were combined, so participants who said they would recommend the site and visit it again was assigned a 1, others were assigned a 0 and the pattern was maintained.

The last regression are a repeat of the third with the new definition of PU that only included PU1,2,3, the relationship is essentially the same as before, so it seems quite valid to remove PU4,5,6 to create a new path as in Figure 7.

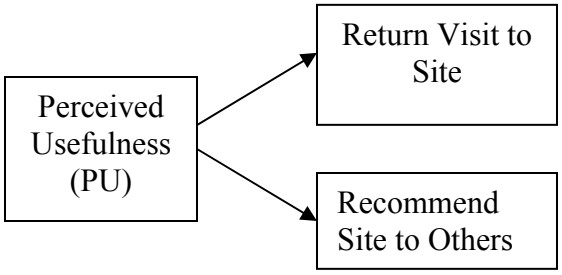

Figure 6: Perceived Usefulness Leads to Return Site Visit and Recommendations to Others

These findings led to the creation of a new model, Figure 8: JAM's SrHI-TAM2.

JAM's SrHI-TAM2

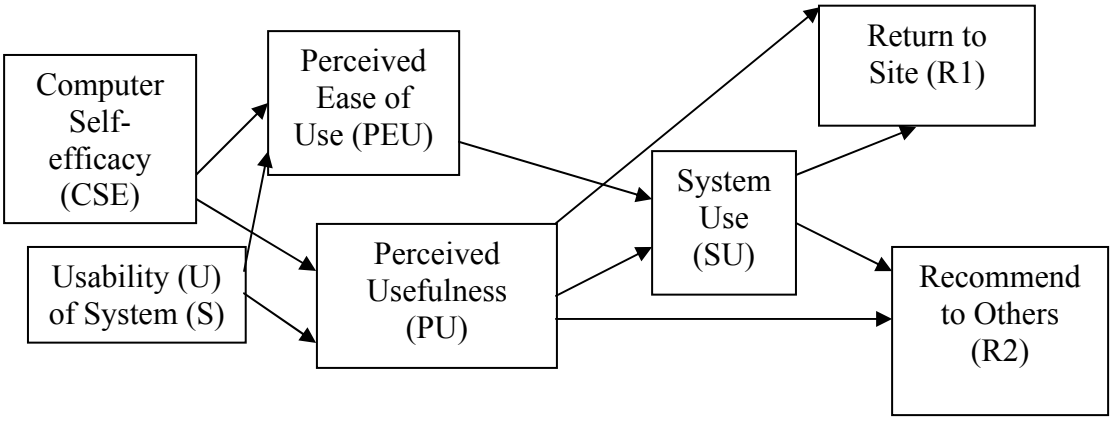

Figure 7: JAM's SrHI-TAM2

Research Question 6, 6a and b

Does SU contribute significantly to information retention (IRO)? Do the number of correct responses increase from the information retention pre-assessment (IRP) to information retention post-assessment (IRO)? If so, is the change significant?

To test the hypothesis that SU positively affects Information Retention, the seniors in the IRP < 8 group were split into 2 subgroups, one that showed improvement as indicated by an improved score on the IRO and one that did not, as shown in Table 8.

Table 8: Information Retention Relative to Intent to Return

		Improved on IRO		Total
		Yes	No	
Intent to Return	Yes	15	11	26
	No	2	1	3
Total		17	12	29

A 2x2 Chi-Square analysis was performed between Intent to Return and the Learning Index which yielded no significant results ($\chi^2_1 = .23$, $p > .05$). In order to accurately classify whether seniors learned new information from the website, the sample was split into two groups: seniors who answered all questions correctly on the pre-assessment assessment and those who did not. Since only seniors who failed to answer all question correctly had a chance to learn new information, the analysis for Information Retention uses only this subgroup. Separate Regressions were run for both groups on the effects of U/PEU on PU ($R^2 = .204$ and $R^2 = .146$ respectively, $p < .05$ for both groups); since this is not a significant difference, participants were pooled for this analysis ($R2 = .174$, $\beta = .417$, $p < .01$) as shown in Table 9.

Table 9: Participants Answering All Content Questions

Variable	B	SE B	β	Sig.
U/PEU	.436	.123	.417	.001

To determine the relationship between PU and seniors' indication of whether they would return to the website and recommend it to others, a logistic regression was run for both groups of seniors, Table 10. Both groups showed similar patterns and thus were pooled for analysis purposes.

Table 10: Two Participant Groups Based on Number of Questions Answered

Group	α	B	SE B	Nagelkerke R^2	Sig.	Exp(B)
IRP < 8	7.943	-.941	.558	.325	.091	.390
IRP = 8	8.018	-1.071	.616	.549	.082	.343
Pooled	8.057	-.975	.362	.432	.007	.377

At .5 classification cutoff this model correctly classified 49 of 53 cases (92.5%) of seniors' intent to return to the website based on the perceived usefulness of the website. Figure 9 shows the Logistic Regression Curve. The Y axis is the probability of indicating intent to return to website. The X axis is the score of PU.

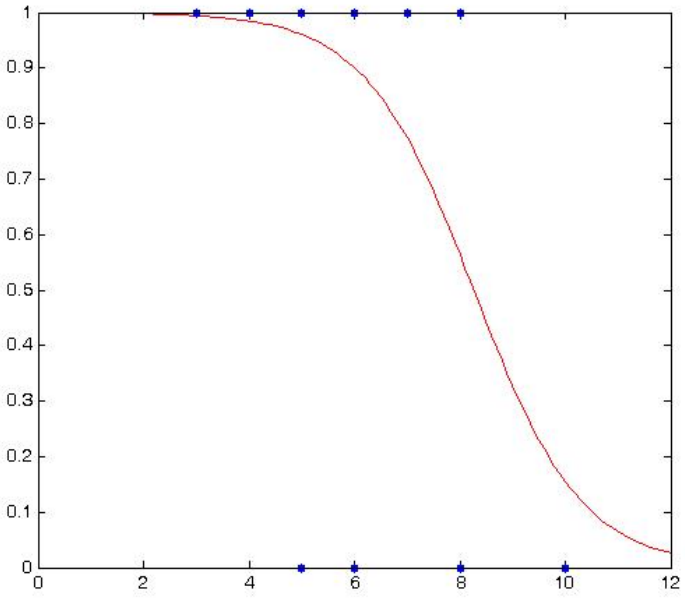

Figure 8: Logistic Regression Curve.
Y axis is probability of indicating intent to return to website, X axis is score of PU.

Attrition Rate

The attrition rate increased significantly after the pre-assessment and navigation. Of the 234 senior participants viewing the introduction, 145 started the pre-assessment. Sixty-eight completed the three sections of the pre-assessment, navigation, and the post-assessment. Qualitative feedback provided some explanations for the drop. The following responses are

reactions and concerns from senior participants, who identified browser problems, ease of use, navigation, and equipment issues:

- "Despite some browser problems last night that postponed my completion of the survey, I just now finished and while all is fresh in my mind I'll make a few comments. ….. After having my first scope at age fifty when three polyps of the type likely to develop into malignancy were removed…"
- "Please be advised that I answered all questions on TWO occasions. In each case there was no "submit" or "send" at the end."
- "I tried to get you survey to be able to filled it, but were unable to do so.
  I am sorry"
- "When I finish the quiz and want to return to the survey, it takes me back to the original page of your instructions and starts all over again ...what am I missing about closing the web site ???? If I X it to close I am back to your original request.....???? Sorry !!!"
- "I just took the survey but I did one and my computer decided to crash before I finished. I got to the zip code. So, I went back and started again. Hope that is OK."
- "Thank you for the opportunity to visit the nih senior health site. I did not know about the site before you gave us the survey; it will be a favorite for me. I did find that your suggestion of printing out the direction page (#1-7) was very beneficial, but I ALSO found the second page important to print out."
- "I am interested in the survey. I'm a dial-up [a dinosaur] and will participate if it doesn't take too long."

- “I finally took the survey. It was very informative. I am going to look up information about my Mom's stroke on that website! I would also love to find out the results of this study.”
- “I am a pretty computer literate person. I started your survey and got to the part where I go to the NIH site. I went through all the info there and way asked to take a survey there. I thought that was your survey and spent some time on it. I then went back to the NIH stuff and took the quiz. After the quiz, I did not see the link to continue the survey. I closed the window and did not get back to your site; I got back to this email. Therefore, I was unable to complete the survey; I do not want to start all over again.”
- “Since a part of this project is "ease of use" I need to let you know that I aborted the project in the "Causes and Risks" section. When I got to the video, the instructions are to either "Download Now" or "install windows media player." "Download now" was not an option that I could find. I already have windows media player installed. Check the page out and let me know where I missed something.”
- Had to do it a second time as, for some reason, half-way through the website, I lost it all. So, went back to the beginning and did complete it all.

The previous comments are associated with the drop-out rate. The following two tables, Table 11 and Table 12**,** show the data and drop points.

Table 11: Attrition Survey Statistics

Survey Statistics	
Viewed	234
Started	145
Completed	68
Completion Rate	46.9%
Drop Outs (After Starting)	77
Average time taken to complete survey : 14 minute(s)	

Table 12 shows the analysis of the points where seniors dropped from the survey. The predominant pivotal point was Q14. That section was the navigation of the site.

Table 12: Drop-Out Analysis

Last Completed Question	**Count**	**Base %**	**Cumulative %**
Section - Introduction	15	19	19
Section - Q 11	3	4	23
Section - Q 2- As far as the Internet ….	1	1	25
Section - Q 12 – Gender	1	1	26
Section - Q 13 – Your zip code	4	5	31
Section - Q 14 – Navigation of site on Internet	46	60	91
Section - Q 26 – Have you viewed the website?	5	6	97
Section - Q20 – The titles made it clear..	1	1	99
Section - Q 21 – I found the information..	1	1	100
Total	**77**	**100**	**100**

QuestionPro (2007). Survey: Internet Health Information Site.

According the QuestionPro, the largest number of drop-outs was 46 participants or 60% after Q 14, which is the instruction section for navigation of the site. The following section is coded Q 26, i.e. *Have you viewed the website?* This identifies that the disconnect was either

immediately after the pre-assessment or after navigation of the site. The sections and questions may be viewed in Appendix C, Table 13.

Qualitative feedback indicated the participants navigated the site, but did not return to the post-assessment. There are two possible explanations for this. First, the site had an internal survey on the site at the same time this research was being conducted. Though instructions included this information about the Fore survey and that it was not a part of this research, the additional quiz may have created some confusion. Second, some participants stated they could not return to the post-assessment. Individuals' comments and feedback provided qualitative data that is relevant to this study.

The HFPs and seniors evaluated the website. The response data was processed through a multivariate GLM (general linear model) and a follow-up pairwise comparison. Regression was used to predict IR based on the predictor variables of CSE, PU, and PEU. Presumably, senior adult user performance related to health information websites is of interest to website designers and developers, senior adult program administrators, health and government professionals.

Data Analysis

Completion of the data analysis provided support for the collected data to confirm it was of adequate size and valid. The measurement and research models were tested by applying a multiple regression approach, using the computer software program of QuestionPro augmented by using SPSS. The sample size of 68 in this study was considered adequate. This study used maximum likelihood estimation to obtain estimates of model parameters, and an R Square level of .10 or higher and statistical significance of <.05 was used for statistical tests.

Summary

The study investigated the effect of usability (U) and computer self-efficacy (CSE) relative to technology acceptance on seniors' IR using JAM's SrHI-TAM. Both U and CSE were added to the hypothetical model to better explain the design and development, as well as seniors' attitude towards using technology for SU and IR. The assessments were framed from five pre-validated instruments in studies by Artis (2005), Evans, et al. (2005), FORE for NIH Survey (2006), Lee (2002), and Mouri, (2005). Though the instruments are adapted from the literature, the author attempted to reaffirm that the instruments carried the validity and reliability to a satisfactory degree. The data was processed by QuestionPro and SPSS 15.0 for Windows to provide the findings. Regression, ANOVA, Chi-Square, and correlations were compatible with the sample size and were used as the procedures to report the findings.

A total of 392 seniors were sent an invitation to participate in the survey. Of those, there were 234 seniors who accessed the introduction. One-hundred forty-five seniors began the survey. Sixty-eight completed the three sections, i.e. the pre-assessment, the site visit, and the post-assessment. Seventy-seven dropped out after starting the first section, for a completion rate of 46.9% of the 145. Qualitative information was included as an explanation for attrition. Some of the reasons included equipment, navigation skills, and access.

The results of the study did not support the model in predicting senior's IR based on U ratings by the HFPs and the participating seniors. The U ratings by HFPs tended to rate the website more poorly than did seniors. The differences were not significant. The U, PEU, and PU contributed to the SU. To test the hypothesis that SU positively affects Information Retention,

the seniors were split into two subgroups. One group showed improvement and the other did not; so a 2x2 Chi-Square analysis was performed between Intent to Return to the site and the learning index. This yielded no significant results.

CHAPTER 5: DISCUSSION AND CONCLUSIONS

Introduction

The formative study investigated the effect of usability and technology acceptance on seniors' information retention using a model developed by the researcher. It is an enhanced version of the original Davis Technology Acceptance Model (1986). The new model provided the critical relationship between the senior health information system and technology acceptance components, i.e. access health information (HI), user's perceived ease of use (PEU), perceived usefulness (PU), system usage (SU), and performance, i.e. information retention (IR). Computer self-efficacy (CSE) and performance were added to the hypothetical model to explain the seniors' technology usage and IR.

Understanding why people accept technology is crucial to the designing and planning of a website for any targeted group (Fucella, et al, 1998). For the study of seniors and health information, colorectal cancer was selected as the topic to investigate for site usability (U) relative to recipient's acceptance and IR. Health information is an important subject to senior adults and the advantages of HI on the Internet is undeniable (Graham & Kingsley, 2005).

The TAM is an information systems theory that models how users come to accept and use technology and a system. The model suggested that when users are presented with a site designed for that segment of the population, a number of factors influence their decision about how and when they will use the system. The PEU and PU are notably two important factors according to Davis (1989). Davis defined PEU as the degree to which a person believes that using a particular system would be free from effort, and PU as the degree to which a person believes that using a particular system would enhance life.

Study Overview

The study looked at the aging population, with focus on health information on the Internet and consideration of usability, computer self-efficacy, PU, PEU, SU, and information retention. The researcher was concerned with the significance of contributing a formative study for scholarly research and literature relative to the growing senior population, health information, technology acceptance and demonstrated information retention. The formative study findings serve as a basis for future studies. The rationale for the research was presented by identifying what was known, what the gap was, the importance of the study, the hypotheses, limitations, methodology, and theory.

A problem identified prior to the study was that health information on the Internet does not accommodate the senior audience. It is not user-friendly and therefore, does not provide the needed and desired service or information to the targeted audience. This negatively impacts retention of new information (DiMaggio et al., 2001).

To investigate technology acceptance and usability specific to seniors, it was incumbent on researchers to choose a usable site for the study because seniors are interested in the information (AARP, 2007). The National Institute on Health (nih) senior health site was selected to be assessed for usability by design experts and seniors. The site was rated high, on five-point and three-point scales.

Purpose of the Study

The purpose of the study was to find out the effects of technology acceptance on seniors' achievement in usage and information retention. According to the literature, there were many studies conducted concerning seniors or technology, but very few studies were conducted on

senior's attitude and acceptance of technology toward the usage and information retention. With respect to technology and usability, most research focuses on younger groups. There is a scarcity of research on seniors' use of the Internet for health information.

Discussion

The primary objective of this study was to test if usability and computer self-efficacy affected PEU, PU, SU, and IR of a senior health information site. Although HI sites are increasingly being used, little theory-driven research has examined the determinants associated with use of a system when that system is used to provide health information. There is virtually no research found on HI systems that examine the impact of specific system characteristics that are thought to be critical for such systems. Further, studies examining the determinants associated with Internet use have not examined specific system characteristics (Carswell & Venkatesh, 2002) that are the focus of this study. Research has not tested models and the hypotheses that such characteristics are determinants of Internet use (Selim, 2003). By examining the impact of the specific system characteristics, the research expanded the knowledge base on important determinants of senior health information Internet use.

It was hypothesized that the Internet HI website's usability ratings by HFP usability experts and users predict IR levels. It was also hypothesized that positive usability ratings relate positively to PEU, PU, SU and senior adult IR. The general hypotheses and sub-directional hypotheses were investigated.

Instruments

The survey instruments were developed to measure constructs by adapting previously validated instruments to fit the senior health information system context. For the system

characteristics, the researcher was able to locate previously validated items that matched the constructs of interest. Therefore, the assessments were based on features considered to be relevant for senior health information systems as cited in the literature review. The study's instruments probed to assess seniors' agreement or disagreement for the items measuring PEU, PU, SU and outcome. QuestionPro had pre-assessmented the instrument on a small sample of individuals via ERI, a survey research firm. While senior perceptions varied, participants generally had favorable perceptions of the senior health information system characteristics (especially system functionality). The respondents had Internet experience and were generally confident in using the system. Positive views were expressed with respect to PEU and PU, and intended SU for supplementary information and retention purposes.

Sample and Data Collection

The professionals were provided with a two-page questionnaire and asked to rate the U based on criterion established by a condensed version from other validated assessment instruments. The questionnaires were completed as the website was viewed and critiqued for usability. The investigator retrieved the hard-copy questionnaires. Validated questionnaires were provided to the senior participants to assess the individuals' PEU and PU of the health information website and user performance, IR. The instruments were completed prior to website access and after navigation of the site. The participants' assessments were Internet-based and generated immediate results through the researcher's secured access to the survey firm's website.

The researcher purposively selected seniors age 50 and older, as this is the age when senior become subjected to new health issues and they prioritize health information as a top interest on the Internet (AARP, 2007).

There were 392 seniors contacted to participate in the study on a voluntary basis. The data were collected in 2006 and 2007 through a questionnaire posted on http://questionpro.com. Of the 392 seniors who were sent the invitation, 234 (59.7%) viewed the introduction. One-hundred forty-five seniors began the survey and 68 completed the three sections, i.e. the pre-assessment, the site visit, and the post-assessment. Seventy-seven dropped after starting the first section, for a completion rate of 46.9%. Since 145 actually started the assessment process, that number is considered the population size for statistical purposes. The following graphic, Figure 10, shows the dropout rate.

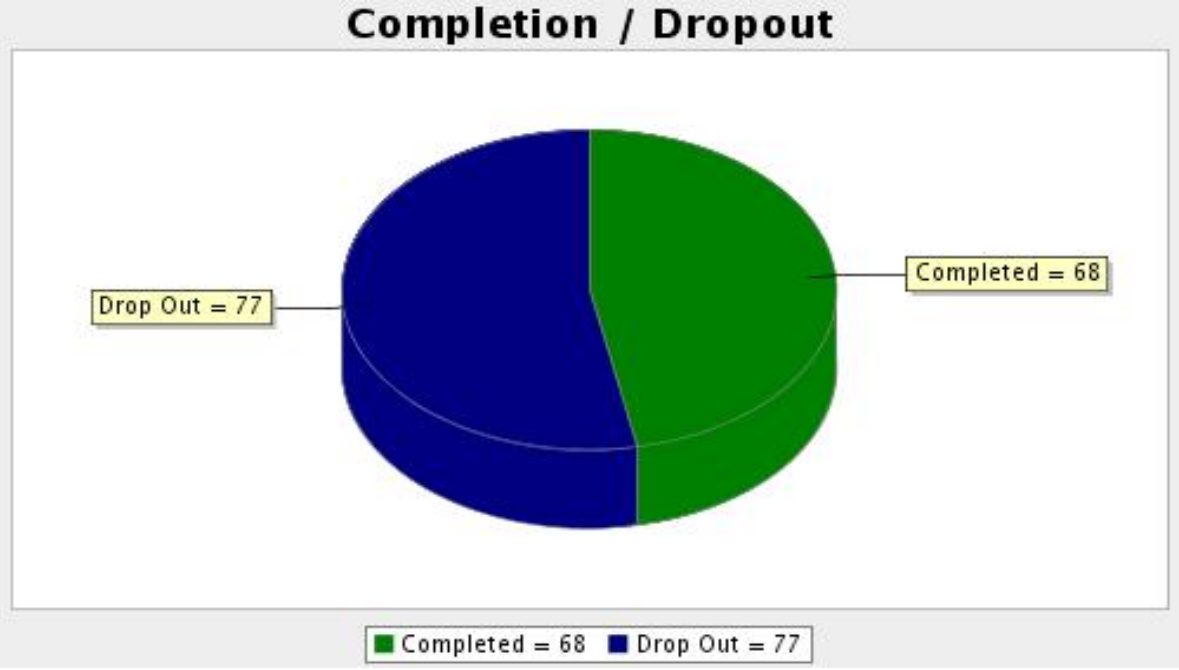

Figure 9: Three Section Study Completion Rate

The researcher used Dillman's (2000) recommendations for number of contacts required per latent participants. There were 22 distribution lists of participants. The original contacts were made via group presentations, organization postings and newsletters, personal contact and

email. The second contact was an email, thank you agreement, survey, or follow-up request. The third contact was an email, thank you agreement, survey, re-sent survey, phone follow-up, or follow-up through referral contact. The fourth contact was the survey, re-sent survey, phone contact, or follow-up through referral contact. The fifth contact was re-sent survey, phone contact, or follow-up through referral contact. Additional contacts were made with participants who had questions or concerns.

Qualitative feedback has been included as a further explanation for attrition. Some of the reasons included equipment, navigation skills, site complexity and access. A review of these concerns should be addressed in complementary research.

The two assessment sections included seven instruments for: usability, computer self-efficacy and attitude, perceived ease of use, perceived usefulness, actual use, information retention and senior demographics. There were eight items to measure usability (section Q 20), six items to measure computer self-efficacy (in section Q 2) and six items to measure attitude (in section Q 29), nine items to measure perceived ease of use (in section Q 20), eight items to measure perceived usefulness (in section Q 21), three items to measure system use (in sections Q 20 and 21), eight items to assess information pre-retention (in section Q 28), eight items to assess information post-retention (in section Q 22), and three demographic items (in sections Q 11, 12 and 13). Some of the items were discarded because they did not contribute to the analysis and findings. Individual items were deleted from each of the variable groups, i.e. usability, and perceived ease of use, perceived usefulness, system use, and demographics.

Research Questions

There were six research questions and four sub-questions posed:

- Is the usability rating by HFPs consistent with the rating by senior participants?
- Does the overall hypothesized model, JAM's SrHi –TAM, fit the data in predicting senior information retention (IRO) based on usability (U) and computer self-efficacy (CSE) ratings of the system?
- Did the site usability contribute significantly to perceived ease of use (PEU) and perceived usefulness (PU)?
- Did the site computer self-efficacy contribute significantly to perceived ease of use (PEU) and perceived usefulness (PU)?
- Do PEU and PU contribute significantly to SU?
    - Is SU positively affected by PEU?
    - Is SU positively affected by PU?
- Does SU contribute significantly to information retention (IRO)?
    - Do the number of correct responses increase from the information retention pre-assessment (IRP) to information retention post-assessment (IRO)?
    - If so, is the change significant?

Research Question 1

Is the usability rating by HFPs consistent with the rating by senior participants?

Seniors tended to rate the website more poorly than did HFPs. A follow-up pairwise comparison revealed near significant effects of groups for items U5 and U9, though no other items approached significance. Both groups rated the usability as near ideal.

Research Question 2, 3, and 4

Does the overall hypothesized model, JAM's SrHi –TAM, fit the data in predicting senior IRO based on usability and computer self-efficacy ratings of the system? Did computer self-effcacy (CSE) and usability (U) contribute significantly to perceived ease of use (PEU) and perceived usefulness (PU)?

For CSE, item 2 and 4 assess a negative attitude while CSE1,3,5 were used as these items assess positive attitudes. For PU proximities, 2 blocks were created. The first (PU1,2,3) asked about the actual information on the website. Block2 (PU4,5,6) asked about whether seniors will return., which actually fits better into System Use (SU). The correlation substantiated this.

The regressions for CSE and U, and CSE and PU show there is no relationship between those variables. The same pattern shows there is no relationship between CSE and PU. There is a null effect. Self efficacy is irrelevant for both the PEU and PU. The third regression is closer to the hypothesis that U affects PU; there is a highly significant though not very strong relation between those variables.

For variable SU, PU4 was a good indicator of SU. So PU4 is recoded as a will return / will not return dichotomy and called the new variable R. Seniors who rated the information as useful are highly likely to return while those who found the information less useful are not. PU6 (whether they'd recommend the site to others) is recoded and the pattern came out even more clearly. One can predict with about 90% certainty whether they will recommend the site based on how useful they thought the information was. Then, the fourth and the fifth items were combined, and the pattern is still maintained.

To further test the hypotheses from the SU level, the seniors were split into two groups. One showed improvement indicated by an improved score on the IRO. The other group did not

show improvement. The Chi-Square analysis between Intent to Return and the Learning Index yielded no significant results.

In this formative study the data did not support the hypothesized model, JAM's SrHi – TAM, in predicting senior information retention (IRO) based on usability (U) and computer self-efficacy (CSE) ratings of the system. With additional participants in a controlled environment with standardized equipment and proctors the findings might differ. The previously sited suggestions are recommended and should be considered for future research.

Research Question 5, 5a and b

Do PEU and PU contribute significantly to SU? Is SU positively affected by PEU? Is SU positively affected by PU?

A standard multiple regression was performed between System Use (SU) as the dependent variable and Perceived Ease of Use (PEU) and Perceived Usefulness (PU) as independent variables. Both Perceived Ease of Use (PEU) and Perceived Usefulness (PU) contributed significantly to System Use (SU). The two independent variables in combination contributed another .2 in shared variability. Together, 20% (18% adjusted) of the variability in system use was predicted by knowing scores on the two.

Research Question 6, 6a and b

Does (SU) contribute significantly to information retention (IRO)? Do the number of correct responses increase from the information retention pre-assessment (IRP) to information retention post-assessment (IRO)? If so, is the change significant?

To test the hypotheses the seniors were split into two groups. One showed improvement indicated by an improved score on the IRO. The other group did not show improvement. The

Chi-Square analysis between Intent to Return and the Learning Index yielded no significant results.

Significant Findings of the Study

1. Both HFP and seniors agreed the site's usability was near ideal. This supported previous researchers' findings.
2. The study using senior participants in the context of their information retention of content on an HI site did not support JAM's SrHi-Techonology Acceptance Model, though other interesting findings surfaced scilicet intent to return to the site and recommendation of the site to others.
3. There is no relationship between usability and computer self-efficacy.
4. Self-efficacy is irrelevant to both perceived ease of use and perceived usefulness.
5. CSE contributed significantly to IRO.
6. Usability affects perceived usefulness.
7. Perceived usefulness is a good indicator of a return visit to the site and recommendation of the site to others.
8. Attrition was attributed to problems with the browser, ease of use, navigation, and equipment issues.

These findings led to the creation of the new model, JAM's SrHI-TAM2, which follows.

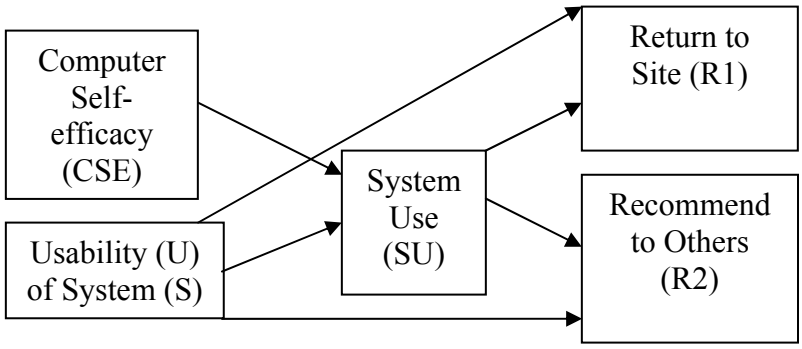

Figure 10: JAM's SrHI-TAM2

Conclusions

Based on established theory and empirical research, this study surfaced some unanticipated findings and demonstrated the importance of defining usability of a site for the audience. Clearly, seniors need implementation of specific design features to enhance the effectiveness of a website for ease of use, usefulness, and system use. As such, this study represents an initial step in highlighting specific system factors that appear to promote system use, projected use, and referrals for senior health information. It did not confirm how such system factors impact use of a health information system for information acquisition and retention purposes; however, two new variables surfaced. These are: the participants would return to this site, and the participants would recommend the site to others. Given the increasing use of health information systems by seniors, a better understanding and implementation of effective system characteristics will enhance the use and value of such systems.

Technology is integrated in many different ways as an extra resource to help seniors' achieve self-managed health care and access to information. It has become important to access information rapidly and visually (Smith, 2002). The Internet sites on HI have been playing a

positive role toward seniors' understanding of health issues (NIH, 1998). Anxiety toward computer usage is a common problem for digital immigrants, especially those over 50 years of age (Baack, Brown, & Brown, 1991). Perceived ease of use and perceived usefulness, as bi-products of a senior friendly site, may contribute to reduced anxiety resulting in increased system use and recommendations of the site to others.

The technology acceptance model was initially designed to predict an end user's acceptance or rejection of an information system. TAM was used for its capability of prediction. The researcher tested and expanded TAM to a senior health information site. The exogenous variables of the hypothetical model were to better explain seniors' attitude toward the acceptance of technology, through usability (U) of a well-designed system and computer self-efficacy (CSE). The study was conducted to explain the usability and acceptance of technology and if it has any bearings toward seniors' achievement in usage and information retention. Clearly, usability design and development and acceptance of technology has a bearing on usage and recommendations to others to use.

Limitations of the Study

Anticipated limitations of the study were the diverse skill and knowledge levels of the participants. Because the participants selected the location to access the survey there were not only different types of computers, but different servers, Internet services, and settings. The differences influenced the perception by participants, as was noted in qualitative feedback. Validity of the study relied on participants' honest responses to the questionnaires and individual responses. The attrition rate increased at a critical point in the process and limited the number of

responses. This may have been the result of browser, equipment, and user failure, as qualitatively identified by participants.

Recommendations for Further Research

According the QuestionPro the largest number of drop-outs was 46 participants, or 60%, after Q 14, which is the instruction section for navigation of the site. The section following Q 14 is coded Q 26, i.e. "*Have you viewed the website?"* This identified that the disconnect was either immediately after the pre-assessment or after navigation of the site. Further research directed at the actual navigation is recommended. Prototyping and field testing of the three sections for flow throughout the entire package should identify potential points of drop-off of participants. Instructional designers should review all three sections for transition between sections. Testing for usability of each individual section would distinguish specific vulnerable items. Emphasis on the number of sections for the assessment and an unproctored environment are additional issues for examination.

The usability of technology showed a positive relationship between the technology and usage, but not information retention. These findings encouraged the author to design a new modified model enhanced with usability, computer self-efficacy, system use, and two new variables, return to the site and recommendations to others. The opportunities to contribute to the senior population and meet senior needs and desires are abundant.

APPENDIX A: IRB LETTER

University of Central Florida

Office of Research & Commercialization

October 9, 2006

Jane A. Madsen
497 West Palm Valley Drive
Oviedo, FL 32765

Dear Ms. Madsen:

With reference to your protocol #06-3856 entitled, "User Performance Relative to Technology Acceptance: Senior Adult Health Information on the Internet," I am enclosing for your records the approved, expedited document of the UCFIRB Form you had submitted to our office. **This study was approved on 10/7/06. The expiration date for this study will be 10/6/2007.** Should there be a need to extend this study, a Continuing Review form must be submitted to the IRB Office for review by the Chairman or full IRB at least one month prior to the expiration date. This is the responsibility of the investigator.

Please be advised that this approval is given for one year. Should there be any addendums or administrative changes to the already approved protocol, they must also be submitted to the Board through use of the Addendum/Modification Request form. Changes should not be initiated until written IRB approval is received. Adverse events should be reported to the IRB as they occur.

Should you have any questions, please do not hesitate to call me at 407-823-2901.

Please accept our best wishes for the success of your endeavors.

Cordially,

Joanne Muratori
UCF IRB Coordinator
(FWA00000351 Exp. 5/13/07, IRB00001138)

Copies: IRB File
Stephen A. Sivo, Ph.D.
Gary Orwig, Ed.D.

JM:jm

12201 Research Parkway • Suite 501 • Orlando, FL 32826-3246 • 407-823-3778 • Fax 407-823-3299

All Institutional Review Board (IRB) information can be obtained via the Internet or from the IRB Coordinator at the Office of Research. Please submit to the following address:

Address:
Office of Research & Commercialization
12201 Research Parkway - Suite 501 Fax: 407-823-3299
Orlando, FL 32826-3246 E-mail: IRB@mail.ucf.edu
The UCFIRB website address is: www.research.ucf.edu/compliance/irb.htm

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UCFIRB Submission Checklist:

__X__ UCFIRB Form [page 24]
__X__ Consent Form [unless study does not use human participants]
Assent Form [if participants are between 7-17 years of age]
_____ School/Class Approval [if using students as participants]
__X__ Copies of Surveys, Tests, Questionnaires, etc. [if applicable]
__X__ Detailed Research Methodology [at least one page minimum]
__N/A Physical or Medical Contingency Plan [if applicable]
__X__ All Department Chairs'/Directors' Signatures [approvals from all involved departments are required]
__X__ Dates of Proposed Research have not Already Expired [see page 6, A-4 for more details]
__X__ Current Mailing Address Provided [attach this as a separate page if you are a student]

Principal Investigator: Jane A. Madsen Date September 23, 2006

Supervising Instructors:

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Associate Professor, Instructional Systems Educational Research, Technology and Leadership
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Homepage: pegasus.cc.ucf.edu/~orwig

Request for Expedited Review

This research study involves no more than minimal risk and falls within one or more of the following categories can receive expedited review under most circumstances:

__ Research conducted in commonly accepted educational settings involving normal educational practices, use of educational tests, survey procedures, interview procedures or observation of public behavior provided that the information obtained is recorded in such a manner that the participants cannot be identified and that any disclosure of the participants' responses outside the research could not reasonably place the participants at risk of criminal or civil liability nor be damaging to the participants' financial standing, employability, or reputation

XX Research on individual or group behavior or characteristics of individuals, such as studies of perception, cognition, game theory, or test development where the Principal Investigator does not manipulate participants' behavior and the research will not involve stress to participants

__ Research and demonstration projects that are designed to study, evaluate, or examine: public benefit or service programs; procedures for obtaining benefits or services under those programs; possible changes in or alternatives to those programs or procedures; or, possible changes in methods or levels of payment for benefits or services under those programs.

UCFIRB Form

1. Title of Project: User Performance Relative to Technology Acceptance: Senior Adult Health Information on the Internet

2. Principal Investigator(s):

Signature:

Name: Jane A. Madsen

Mr./Ms./Mrs./Dr. (circle one)

Degree: M.S., M.P.A.

Title: Ph.D. Candidate

Department: Educational Research, Technology, and Leadership

College: The College of Education

Email: jmadsen@mail.ucf.edu

Telephone: 407/312-6311

Facsimile: 407/359-5552

Home Phone: 407/359-5552

3. Faculty Supervisors:

Signature:

Name: Stephen A. Sivo

Mr./Ms./Mrs./Dr. (circle one)

Department: ERTL

College: The College of Education

Degree: Ph.D.

Title: Associate Professor

Office Phone: 407/823-4147

Facsimile: 407/823-5144

E-mail:

ssivo@mail.ucf.edu

Signature:

Name: Gary Orwig

Mr./Ms./Mrs./Dr. (circle one)

Department: ERTL

College: The College of Education

Degree: Ed.D.

Title: Professor

Office Phone: 407/823-5179

Email: orwig@mail.ucf.edu

Homepage:pegasus.cc.ucf.edu/~orwig

4. Dates of Proposed Project (cannot be retroactive): From: **_Oct. 21, 2006** To: **Oct. 20, 2007**

I, JANE A. MADSEN, WILL NOT BEGIN THE RESEARCH UNTIL I HAVE OBTAINED IRB APPROVAL.

5. Source of Funding for the Project: (project title, agency, and account number):

This project is unfunded.

6. Scientific Purpose of the Investigation: The purpose of this study is to investigate the relationship between technology acceptance, usability, and performance of 200 senior adults in accessing health information through the Internet. The Technology Acceptance Model will be modified to include performance outcome. Three design experts will assess usability. Cognitive and physical skills limitations of the aged will be defined, as these should drive website development and design.

7. **Describe the Research Methodology in Non-Technical Language: (the UCFIRB needs to know what will be done with or to the research participants)**

Three groups will be surveyed. One group consists of three usability experts with a minimum of three years experience as professional designers. These professionals will respond to a questionnaire to review usability of the health information Internet site. The 200 senior adults will be 50 and older. Both groups of seniors will complete a pre-assessment prior to accessing the health information site. This will provide baseline data for both. After the pre-assessment is completed the senior participants will receive instructions to access the designated site. Their navigation will not be timed due to the diverse level of cognitive and physical skills of senior adults. After completing this activity the senior participants will complete a post-assessment. Quantitative methods will be used to compare pre-assessment and post-assessment responses, which will identify prior knowledge with specific knowledge gained during the online activity. The professionals' assessment of the site will be compared to the users' assessment. The senior participants will be asked to provide demographics that will be used to identify patterns related to performance. The senior participants will be from QuestionPro and eRewards Research (ERI), two firms specializing in research and identifying and surveying specific populations. The research will be used to determine the relationships existing between the system, usability, attitude toward using, perceived ease of use and perceived usefulness, actual use and information retention. There will be no manipulation of the variables, as the investigation will focus on the extent to which the variables are related. The strength and direction of the relation will be described by means of a quantitative index to clarify relationships and patterns among the variables. Causal analysis will explore panel data by using cross-tabulations.

As a formative study, the research will help describe the causal relationship and patterns of the studied variables through a modified version of Davis's Technology Acceptance Model, from the system through user performance.

8. **Potential Benefits and Anticipated Risks:**

There are no anticipated risks. Any compensation or other direct benefits for participation in this research project would be handled by the research firms, exclusive of the investigator. Participants are free to withdraw and may discontinue participation at any time without consequences. Participant responses will be analyzed and reported anonymously to protect their privacy. The information collected will be kept on a secured server and be password protected.

Physical documentation collected will be filed in a locked secure file, accessible to only the principal investigator.

9. Describe how participants will be recruited, the number and age of the participants, and proposed compensation (if any): Participants will be OVER the age of 18 (no minors will be included). The three usability experts will be professionals recruited from local Orlando, Florida organizations. Each will have a minimum of three years of design and usability experience. They are professionals, who have taken graduate courses through UCF, and are known to the investigator as professional colleagues. The 200 senior adults will be age 50 and older. All will be Internet users. Receipt of the findings will be available to participants if desired and requested. The senior surveys will be administered through QuestionPro software in collaboration with ERI, a research firm specializing in surveys that maintains a database of over 1.5 million panelists. The participants are pre-screened and selected from the database, and ERI maintains the confidential information.

10. Describe the informed consent process: (include a copy of the informed consent document)

The usability experts receive a copy to read and if they are willing to participate, they will sign the copy and it will be kept on file. A second copy will be provided to the participant for his/her records. A copy of the letter along with the questionnaire protocol (as needed) and sample instrument is included with this IRB application. Participants of the online questionnaires are pre-screened by ERI, who maintains the confidential information. They will receive a copy of the consent form through QuestionPro.

The student researcher is a doctoral candidate using information collected toward partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Educational Research, Technology and Leadership in the College of Education at the University of Central Florida Orlando, Florida.

Letter of Informed Consent

Senior Adult Performance Relative to Technology Acceptance

Dear Usability Expert:

I am a Ph.D. candidate at the University of Central Florida under the supervision of Dr. Stephen A. Sivo, Senior Researcher, and Dr. Gary Orwig, Professor, Educational Research, Technology, and Leadership, conducting a study for the purpose of researching the usability of senior adult health information on the Internet. The results of the study may help identify gaps between the system, usability, perceived ease of use, perceived usefulness, attitude toward using, actual system use, and user performance.

You are being invited because you have been identified as an expert in design and usability. Please be aware that you are not required to participate in this research and you may discontinue your participation at any time without penalty. You may use "NO" for any questions you prefer not to answer. The questionnaire should be completed at a location where you can access the Internet, as the rating should be accomplished while you navigate the designated site. Please allow 30 to 45 minutes to review the site and respond to the questionnaire, which should be completed and submitted no later than October 23rd.

As the principal researcher, I assure you that your identity will be kept confidential. The testing service de-identifies the data and gives it to me in the aggregated. Your responses will be analyzed and reported anonymously to protect your privacy.

You must be 18 years of age or older to participate. There are no anticipated risks. The researcher will provide a copy of the research findings through email, if requested by the participant. The request, including the recipient's email address, should be indicated in the section near the end of the letter of informed consent. You are free to withdraw your consent to participate and may discontinue your participation in the survey at any time without consequences. If you have any questions about this research project, please contact me at 407/312-6311 or my faculty supervisors, Dr. Sivo at 407/823-4147, or Dr. Orwig at 407/823-5179. Information regarding your rights as a research volunteer may be obtained from:

Barbara Ward, Institutional Review Board (IRB) University of Central Florida (UCF)
12443 Research Parkway, Suite 501; Orlando, Florida 32826-3246 Telephone: (407) 882-2901

The hours of operation are 8:00 am until 5:00 pm, Monday through Friday except on University of Central Florida official holidays. The phone number is (407) 823-2901.

Your identity will be kept confidential. Your responses will be analyzed and reported anonymously to protect your privacy.

If you decide to participate in this research study, please acknowledge and return the consent form no later then October 22nd. A second copy will be provided for your records. Please allow 30 to 45 minutes to review the site and respond to the questionnaire, which ahould be completed and submitted no later than October 23rd.

Sincerely, _____

Jane A. Madsen, Principal Investigator, Ph.D. Candidate, College of Education at the University of Central Florida

Project title: The Senior Adult Health Information Technology Acceptance Relative to User Performance

___I have read the procedure described above. I have read the "Informed Consent to Participate" and agree to allow the researcher to use the information I provide for related presentations and publications.

___I voluntarily agree to participate in the study.

_____ _____

Participant Date

Letter of Informed Consent
Senior Adult Performance Relative to Technology Acceptance

Dear Participant:

I am a Ph.D. candidate at the University of Central Florida under the supervision of Dr. Stephen A. Sivo, Senior Researcher, and Dr. Gary Orwig, Professor, Educational Research, Technology, and Leadership, conducting a study for, the purpose of researching the usability of senior adult health information on the Internet. The results of the study may help identify gaps between the system, usability, perceived ease of use, perceived usefulness, attitude toward using, actual system use, and user performance.

You are being invited because you have been identified as a mature adult Internet user. Please be aware that you are not required to participate in this research and you may discontinue your participation at any time without penalty. You may use "NO" for any questions you prefer not to answer. The questionnaires will be released October 25th. It may be completed on your personal computer or at any convenient computer that has access to the Internet. Please allow 20 to 30 minutes for the pre-assessment, the site visit, and the post-assessment. To be included in the findings, your participation should be completed no later than November 3rd.

As the principal researcher, Questioner and ERI will provide me access to the survey responses. You may be assured that your identity will be kept confidential. Your responses will be analyzed and reported anonymously to protect your privacy.

You must be 18 years of age or older to participate. There are no anticipated risks. Any compensation or other direct benefits to you as a participant in this study are not provided by the researcher. Results of the research findings will be provided by the researcher at your request, which you may indicate in the section near the end of this letter. You are free to withdraw your consent to participate and may discontinue your participation in the survey at any time without consequences. If you have any questions about this research project, please contact me at 407/312-6311 or my faculty supervisors, Dr. Orwig at 407/823-5179, or Dr. Sivo at 407/823-4147. Information regarding your rights as a research volunteer may be obtained from:

Barbara Ward, Institutional Review Board (IRB) University of Central Florida (UCF)
12443 Research Parkway, Suite 302; Orlando, Florida 32826-3252 Telephone: (407) 823-2901

The hours of operation are 8:00 am until 5:00 pm, Monday through Friday except on University of Central Florida official holidays. The phone number is (407) 823-2901.

Your identity will be kept confidential. Your responses will be analyzed and reported anonymously to protect your privacy.

If you decide to participate in this research study, please acknowledge and return the consent form no later than October 24th. A second copy will be provided for your records. Please allow 20 to 30 minutes for the pre-assessment, the site visit, and the post-assessement.

Sincerely, _____

Jane A. Madsen, Principal Investigator, Ph.D. Candidate, College of Education at the University of Central Florida

Project title: Senior Adult Health Information Technology Acceptance Relative to User Performance

___I have read the procedure described above. I have read the "Informed Consent to Participate" and agree to allow the researcher to use the information I provide for related presentations and publications.

___I voluntarily agree to participate in the study.

___I would like to see the results of the research and am requesting a copy be sent to my email

address, which is _____.

_____ _____

Participant Date

Directions and Questionnaire for Usability Expert

Usability Expert's Instructions to Access Website for Study:

1. Open your Internet Browser

    -For Address enter "http://nihseniorhealth.gov/," Enter

2. Cursor Down

    -Go to "Click to Begin" – Click

3. Cursor down to "Colorectal Cancer" – Click

    There are six (6) sections to this topic. You are asked to navigate through two (2) of the sections, i.e. "Colorectal Cancer Defined" and "Causes and Risk Factors"

4. Below "Table of Contents"

    -Select "Colorectal Cancer Defined" - Click

    -Read, then double click "Next Page" to proceed, and Read

5. Follow the same procedures to go through the topic

6. When you get to the image "Click on Image to Enlarge"

    – Read

7. Click on arrow to return to "Previous Page" and continue through remainder of this section

    If at any time the "NIH Senior Health Survey" screen appears, "X" to return to "Colorectal Cancer Defined" or "Causes and Risk Factors" and proceed.

8. Please take the short quiz. The score is for your use only and will not be recorded for any other purpose.

9. Repeat Instructions to go through the next section, i.e. "Causes and Risk Factors" and the quiz

Once you have completed this navigation, please complete the usability questionnaire

Thank you!!!

Participant's Instructions to Access Website for Study:

1. Open your Internet Browser

    -For Address enter "http://nihseniorhealth.gov/," Enter

2. Cursor Down

    -Go to "Click to Begin" – Click

3. Cursor down to "Colorectal Cancer" – Click

    There are six (6) sections to this topic. You are asked to navigate through two (2) of the sections, i.e. "Colorectal Cancer Defined" and "Causes and Risk Factors"

4. Below "Table of Contents"

    -Select "Colorectal Cancer Defined" - Click

    -Read, then double click "Next Page" to proceed, and Read

5.Follow the same procedures to go through the topic

6. When you get to the image "Click on Image to Enlarge" – Read

7. Click on arrow to return to "Previous Page" and continue through remainder of this section

    (Directions Continue on Following Page)

    If at any time the "NIH Senior Health Survey" screen appears, "X" to return to "Colorectal Cancer Defined" or "Causes and Risk Factors" and proceed

8. Please take the short quiz. The score is for your use only and will not be recorded for any other purpose

9. Repeat Instructions to go through the next section, i.e. "Causes and Risk Factors" and the quiz

    Once you have completed this navigation, please complete the QuestionPro questionnaire.

APPENDIX B: ASSESSMENTS

Seniors' Health Information Internet Site Usability Expert	
Introduction:	Thank you for your willingness to participate in this study. You were selected to take part in this survey because of your knowledge and experience with usability. The following questionnaire has been designed to assess the usability of a health information site for senior adults (50 years and older). Your input, as a professional, is critical to analyzing the role of design and usability. To determine the effectiveness of the Internet site, you will need to access and navigate through two sections of colorectal cancer on nihseniorhealth.gov.
Please Note: CONFIDENTIAL	The information gathered during this usability analysis is confidential and will be maintained in a secured file accessible solely to the researcher. This information will help determine how well the site meets senior adults' needs and identify design characteristics for improvement.
Information: Name: _____ Number of years/months of design and usability critiquing experience: 6 years, 30 years, 6 years, 15 years	

Directions:	Each of the statements below focuses on a different aspect of the website. Using the rating scale next to each statement, rate each statement by circling the number that most closely matches your opinion. For all statements rated "Disagree" or "Strongly Disagree" please provide an explanation in the Comments space at the end. Provide further explanation whenever necessary, as well as any comments that you feel will help clarify your response.

Scale:	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree

		SD/1	D/2	O/3	A/4	SA/5	
1.	The **titles** are easy to see and read.				XX	XX	18/4
2.	The **titles** made it clear which section was being viewed.				XX	XX	18/4
3.	The **text** is easy to see and read.				XX	XX	18/4
4.	The **size and color** of the prompt text is easy to see and read.				XX	XX	18/4
5.	The site provides **information** that is helpful when using.			X	X	XX	17/4
6.	The **language** used to provide information is conversational and **easy to understand**.				XX	XX	18/4
7.	The site is **easy to read**.				XX	XX	18/4
8.	The **speed** of the site is consistent.			X	XX	X	16/4
9.	Screen **graphics** are clear and easy to see.		X		XX	X	15/4

Scale:	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree

		SD/1	D/2	O/3	A/4	SA/5	
10.	The formatting of the bullets and text is consistent.				X	XXX	19/4
11.	The **layout** of this site is **clean**.				X	XXX	19/4
12.	The layout of the site is logical and easy to use.				X	XXX	19/4
13.	There is consistency throughout the site including terms, abbreviations, and capitalization.				XX	XX	18/4
14.	The 'Previous Page' and 'Next Page' icons are functioning.				XX	XX	18/4
15.	The site performance is reliable.			X	X	XX	
16.	The access to the previous page and the next page was obvious through the **icon**.				XX	XX	18/4
17.	Using the **icons** to locate site information was a simple, effective way of finding information.				XXX	X	17/4
18.	It was clear how to **exit** each section.				XXX	X	17/4
19.	The website was **user friendly**.				XXX	X	17/4
20.	Prompts **explaining** how to use the site were clear.			XX	X	X	15/4
21.	Relevant information can be found quickly.			XX	X	X	15/4
22.	The **site map** or directory provides clear direction.				XXX	X	17/4

Scale:	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree

		SD/1	D/2	O/3	A/4	SA/5	
23.	The site is easy to **navigate**.				XXX	X	17/4
24.	The **hypertext** [colored and underlined word(s)] all **function** when clicked**.**				X	XXX	19/4
25.	The **hypertext** [colored and underlined word(s)] is recognizable and easy to read.				XX	XX	18/4
26.	In your professional opinion, how does this site compare to your idea of an **ideal website**?				XX	XX	18/4
27.	Is there **anything frustrating or difficult** to understand on the site? If "Yes" please explain.	Yes - X			No- XXX		
28.	What features need to be **added/improved** to make nihseniorhealth.gov more useful? No Yes, links to more in-depth information Yes, graphic and video pop-ups should have toolbar turned off Positive comment – Ability to expand text size and add voice narration provided a lot of flexibility and usability to users						
29.	What **additional** information would you like to see provided to make the website more useful? None Yes, links to more in-depth information Yes, correct quiz answers were much longer than distractors None						
30. Additional **Comments**: When clicking on image to enlarge, image size does not increase that much. "Previous" button should be changed							

Scale:	1 Strongly Disagree	2 Disagree	3 No Opinion	4 Agree	5 Strongly Agree

		SD/1	D/2	O/3	A/4	SA/5		

to “Close” button.

You’re FINISHED!!!

Again, thank you for your time and candid contributions to this Usability Study. Your input and feedback will assist in research on Internet Health Information for Seniors. Your comments are appreciated. **Thank you**. If you have any questions please refer them to: **Jane Madsen at jmadsen@mail.ucf.edu**

APPENDIX C: RESPONSES

Table 13: Survey Stats

Survey Statistics	
Viewed	234
Started	145
Completed	68
Completion Rate	46.9%
Drop Outs (After Starting)	77

- Average time taken to complete survey : 14 minute(s)

The age bracket you are in is:

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**50 through 64**	**69**	**53.08%**	
2.	65 and older	61	46.92%	
	Total	**130**	**100%**	

Key Analytics

Mean	1.469
Confidence Interval @ 95%	[1.383 - 1.555] n = 130
Standard Deviation	0.501

Directions: Using the rating scale next to each statement, rate each statement by selecting the response that most closely matches your opinion. There are no correct responses.

Computer Self-efficacy

Overall Matrix Scorecard

	Question	Count	Score	Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree
1.	As far as the Internet goes, I consider myself to be very competent.	119	1.966	
2.	I find working on the Internet very frustrating.	120	3.883	
3.	I am very confident in my abilities to use the Internet to find health information.	119	1.983	
4.	I seem to waste a lot of time struggling with different websites to find information.	119	3.345	
5.	I find using the Internet to access health information very easy.	119	2.361	
Average			**2.708**	

As far as the Internet goes, I consider myself to be very competent.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	44	36.97%	
2.	**Agree**	**49**	**41.18%**	
3.	Neutral	14	11.76%	
4.	Disagree	10	8.40%	
5.	Strongly Disagree	2	1.68%	
	Total	**119**	**100%**	

Key Analytics

Mean	1.966
Confidence Interval @ 95%	[1.788 - 2.144] n = 119
Standard Deviation	0.991

Key Facts

- **78.15%** chose the following options :
  - Agree

I find working on the Internet very frustrating.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	5	4.17%	
2.	Agree	9	7.50%	
3.	Neutral	15	12.50%	
4.	**Disagree**	**57**	**47.50%**	
5.	Strongly Disagree	34	28.33%	
	Total	**120**	**100%**	

Key Analytics

Mean	3.883
Confidence Interval @ 95%	[3.698 - 4.069] n = 120
Standard Deviation	1.039
Standard Error	0.095

Key Facts

- **75.83%** chose the following options :
  - Disagree
  - Strongly Disagree
- Least chosen option **4.17%** :

I am very confident in my abilities to use the Internet to find health information.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	37	31.09%	
2.	**Agree**	**54**	**45.38%**	
3.	Neutral	22	18.49%	
4.	Disagree	5	4.20%	
5.	Strongly Disagree	1	0.84%	
	Total	**119**	**100%**	

Key Analytics

Mean	1.983
Confidence Interval @ 95%	[1.828 - 2.138] n = 119
Standard Deviation	0.863
Standard Error	0.079

Key Facts

- **76.47%** chose the following options :
  - Agree
  - Strongly Agree
- Least chosen option **0.84%** :

I seem to waste a lot of time struggling with different websites to find information

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	8	6.72%	
2.	Agree	29	24.37%	
3.	Neutral	17	14.29%	
4.	**Disagree**	**44**	**36.97%**	
5.	Strongly Disagree	21	17.65%	
	Total	**119**	**100%**	

Key Analytics

Mean	3.345
Confidence Interval @ 95%	[3.126 - 3.563] n = 119
Standard Deviation	1.217
Standard Error	0.112

Key Facts

- **61.34%** chose the following options :
  - Disagree
  - Agree
- Least chosen option **6.72%** :

I find using the Internet to access health information very easy.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	24	20.17%	
2.	**Agree**	**50**	**42.02%**	
3.	Neutral	23	19.33%	
4.	Disagree	22	18.49%	
5.	Strongly Disagree	0	0.00%	
	Total	**119**	**100%**	

Key Analytics

Mean	2.361
Confidence Interval @ 95%	[2.181 - 2.542] n = 119
Standard Deviation	1.006
Standard Error	0.092

Key Facts

- **62.18%** chose the following options :
  - Agree

Attitude (AT)

Overall Matrix Scorecard

	Question	Count	Score	Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree
1.	I find the Internet gets in the way of learning health information.	120	4.042	
2.	Using the Internet makes learning about health information more interesting.	121	1.942	
3.	I always seem to have problems when trying to find health information on the Internet.	121	3.785	
4.	Computer/Internet jargon baffles me and distracts from finding health information.	121	3.967	
5.	The Internet is a good aid to learning about health information.	121	1.736	
6.	The Internet helps me to save a lot of time to find health information.	120	1.867	
	Average		**2.890**	

I find the Internet gets in the way of learning health information.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	4	3.33%	
2.	Agree	5	4.17%	
3.	Neutral	12	10.00%	
4.	**Disagree**	**60**	**50.00%**	
5.	Strongly Disagree	39	32.50%	
	Total	**120**	**100%**	

Key Analytics

Mean	4.042
Confidence Interval @ 95%	[3.872 - 4.211] n = 120
Standard Deviation	0.947
Standard Error	0.086

Key Facts

- **82.5%** chose the following options :
  - Disagree
  - Strongly Disagree
- Least chosen option **3.33%** :

Using the Internet makes learning about health information more interesting

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	26	21.49%	
2.	**Agree**	**77**	**63.64%**	
3.	Neutral	17	14.05%	
4.	Disagree	1	0.83%	
5.	Strongly Disagree	0	0.00%	
	Total	**121**	**100%**	

Key Analytics

Mean	1.942
Confidence Interval @ 95%	[1.831 - 2.053] n = 121
Standard Deviation	0.623
Standard Error	0.057

Key Facts

- **85.12%** chose the following options :
  - Agree

I always seem to have problems when trying to find health information on the Internet.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	4	3.31%	
2.	Agree	11	9.09%	
3.	Neutral	16	13.22%	
4.	**Disagree**	**66**	**54.55%**	
5.	Strongly Disagree	24	19.83%	
	Total	**121**	**100%**	

Key Analytics

Mean	3.785
Confidence Interval @ 95%	[3.611 - 3.959] n = 121
Standard Deviation	0.976
Standard Error	0.089

Key Facts

- **74.38%** chose the following options :
  - Disagree
  - Strongly Disagree
- Least chosen option **3.31%** :

Computer/Internet jargon baffles me and distracts from finding health information.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	4	3.31%	
2.	Agree	8	6.61%	
3.	Neutral	12	9.92%	
4.	**Disagree**	**61**	**50.41%**	
5.	Strongly Disagree	36	29.75%	
	Total	**121**	**100%**	

Key Analytics

Mean	3.967
Confidence Interval @ 95%	[3.792 - 4.142] n = 121
Standard Deviation	0.983
Standard Error	0.089

Key Facts

- **80.17%** chose the following options :
  - Disagree
  - Strongly Disagree
- Least chosen option **3.31%** :

The Internet is a good aid to learning about health information.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	43	35.54%	
2.	**Agree**	**70**	**57.85%**	
3.	Neutral	5	4.13%	
4.	Disagree	3	2.48%	
5.	Strongly Disagree	0	0.00%	
	Total	**121**	**100%**	

Key Analytics

Mean	1.736
Confidence Interval @ 95%	[1.619 - 1.852] n = 121
Standard Deviation	0.655
Standard Error	0.060

Key Facts

- **93.39%** chose the following options :
  - Agree

The Internet helps me to save a lot of time to find health information.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	40	33.33%	
2.	**Agree**	**60**	**50.00%**	
3.	Neutral	16	13.33%	
4.	Disagree	4	3.33%	
5.	Strongly Disagree	0	0.00%	
	Total	**120**	**100%**	

Key Analytics

Mean	1.867
Confidence Interval @ 95%	[1.730 - 2.004] n = 120
Standard Deviation	0.766
Standard Error	0.070

Key Facts

- **83.33%** chose the following options :
  - Agree

Information Retention Pre-test (IRP)

Overall Matrix Scorecard

	Question	Count	Score	True	False	Do Not Know
1.	Cancer is a disease where cells divide and grow normally.	122	1.959			
2.	Colorectal cancer is responsible for fewer deaths each year than any other type of cancer.	122	2.164			
3.	Metastatic colorectal cancer is cancer that has spread from the colon or rectum to another part of the body.	122	1.410			
4.	If colorectal cancer is found early, it is very likely to be cured.	122	1.139			
5.	Polyps are growths in the colon and rectum that are usually benign.	122	1.270			
6.	Your risk of colorectal cancer goes up if you spend too much time in the sun.	122	2.189			
7.	You may reduce your risk factors for colorectal cancer by eating a diet low in saturated fat and increasing the amount of exercise you get.	122	1.385			
8.	Having one or more of the risk factors for colorectal cancer means that you will develop the disease.	122	2.074			
		Average	**1.699**			

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	True	13	10.66%	
2.	**False**	**101**	**82.79%**	
3.	Do Not Know	8	6.56%	
	Total	**122**	**100%**	

Key Analytics

Mean	1.959
Confidence Interval @ 95%	[1.885 - 2.033] n = 122
Standard Deviation	0.415

Key Facts

- **93.44%** chose the following options :
  - False

Colorectal cancer is responsible for fewer deaths each year than any other type of cancer.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	True	6	4.92%	
2.	**False**	**90**	**73.77%**	
3.	Do Not Know	26	21.31%	
	Total	**122**	**100%**	

Key Analytics

Mean	2.164
Confidence Interval @ 95%	[2.077 - 2.250] n = 122
Standard Deviation	0.487
Standard Error	0.044

Key Facts

- **95.08%** chose the following options :
  - False
  - Do Not Know
- Least chosen option **4.92%** :

Metastatic colorectal cancer is cancer that has spread from the colon or rectum to another part of the body.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**True**	**95**	**77.87%**	
2.	False	4	3.28%	
3.	Do Not Know	23	18.85%	
	Total	**122**	**100%**	

Key Analytics

Mean	1.410
Confidence Interval @ 95%	[1.270 - 1.550] n = 122
Standard Deviation	0.790
Standard Error	0.072

Key Facts

- **96.72%** chose the following options :
  - True
  - Do Not Know
- Least chosen option **3.28%** :

If colorectal cancer is found early, it is very likely to be cured.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**True**	**113**	**92.62%**	
2.	False	1	0.82%	
3.	Do Not Know	8	6.56%	
	Total	**122**	**100%**	

Key Analytics

Mean	1.139
Confidence Interval @ 95%	[1.050 - 1.229] n = 122
Standard Deviation	0.503
Standard Error	0.046

Key Facts

- **99.18%** chose the following options :
  - True
  - Do Not Know
- Least chosen option **0.82%** :

Polyps are growths in the colon and rectum that are usually benign.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**True**	**102**	**83.61%**	
2.	False	7	5.74%	
3.	Do Not Know	13	10.66%	
	Total	**122**	**100%**	

Key Analytics

Mean	1.270
Confidence Interval @ 95%	[1.156 - 1.385] n = 122
Standard Deviation	0.643
Standard Error	0.058

Key Facts

- **94.26%** chose the following options :
  - True
  - Do Not Know
- Least chosen option **5.74%** :

Your risk of colorectal cancer goes up if you spend too much time in the sun.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	True	5	4.10%	
2.	**False**	**89**	**72.95%**	
3.	Do Not Know	28	22.95%	
	Total	**122**	**100%**	

Key Analytics

Mean	2.189
Confidence Interval @ 95%	[2.102 - 2.275] n = 122
Standard Deviation	0.487
Standard Error	0.044

Key Facts

- **95.9%** chose the following options :
  - False
  - Do Not Know
- Least chosen option **4.1%** :

You may reduce your risk factors for colorectal cancer by eating a diet low in saturated fat and increasing the amount of exercise you get.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**True**	**95**	**77.87%**	
2.	False	7	5.74%	
3.	Do Not Know	20	16.39%	
	Total	**122**	**100%**	

Key Analytics

Mean	1.385
Confidence Interval @ 95%	[1.251 - 1.519] n = 122
Standard Deviation	0.755
Standard Error	0.068

Key Facts

- **94.26%** chose the following options :
  - True
  - Do Not Know
- Least chosen option **5.74%** :

Having one or more of the risk factors for colorectal cancer means that you will develop the disease.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	True	6	4.92%	
2.	**False**	**101**	**82.79%**	
3.	Do Not Know	15	12.30%	
	Total	**122**	**100%**	

Key Analytics

Mean	2.074
Confidence Interval @ 95%	[2.001 - 2.147] n = 122
Standard Deviation	0.410
Standard Error	0.037

Key Facts

- **95.08%** chose the following options :
  - False
  - Do Not Know
- Least chosen option **4.92%** :

Your gender is:

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Male	59	46.83%	
2.	**Female**	**67**	**53.17%**	
	Total	**126**	**100%**	

Key Analytics

Mean	1.532
Confidence Interval @ 95%	[1.444 - 1.619] n = 126
Standard Deviation	0.501

Have you viewed the website?

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**Yes**	**67**	**89.33%**	
2.	No	8	10.67%	
	Total	**75**	**100%**	

Key Analytics

Mean	1.107
Confidence Interval @ 95%	[1.036 - 1.177] n = 75
Standard Deviation	0.311

Next are the questions based on the website you just visited.

U / PEU

Overall Matrix Scorecard

	Question	Count	Score	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
1.	The titles made it clear which section was being viewed	64	1.359					
2.	The text was easy to see and read.	64	1.359					
3.	The language used to provide information was conversational and easy to understand.	64	1.406					
4.	The screen graphics were clear and easy for me to see.	64	1.531					
5.	The layout of the site was logical and easy to use.	64	1.484					
6.	Using the icons to locate site information was a simple, effective way of finding information.	63	1.619					
7.	The website was user friendly.	63	1.444					
8.	Prompts explaining how to use the site were clear.	64	1.562					
		Average	**1.471**					

The titles made it clear which section was being viewed.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**Strongly Agree**	**41**	**64.06%**	
2.	Agree	23	35.94%	
3.	No Opinion	0	0.00%	
4.	Disagree	0	0.00%	
5.	Strongly Disagree	0	0.00%	
	Total	**64**	**100%**	

Key Analytics

Mean	1.359
Confidence Interval @ 95%	[1.241 - 1.478] n = 64
Standard Deviation	0.484
Standard Error	0.060

Key Facts

- **100%** chose the following options :
  - Strongly Agree

The text was easy to see and read.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**Strongly Agree**	**42**	**65.62%**	
2.	Agree	21	32.81%	
3.	No Opinion	1	1.56%	
4.	Disagree	0	0.00%	
5.	Strongly Disagree	0	0.00%	
	Total	**64**	**100%**	

Key Analytics

Mean	1.359
Confidence Interval @ 95%	[1.233 - 1.486] n = 64
Standard Deviation	0.515
Standard Error	0.064

Key Facts

- **98.44%** chose the following options :
  - Strongly Agree

The language used to provide information was conversational and easy to understand.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**Strongly Agree**	**40**	**62.50%**	
2.	Agree	23	35.94%	
3.	No Opinion	0	0.00%	
4.	Disagree	1	1.56%	
5.	Strongly Disagree	0	0.00%	
	Total	**64**	**100%**	

Key Analytics

Mean	1.406
Confidence Interval @ 95%	[1.263 - 1.549] n = 64
Standard Deviation	0.583
Standard Error	0.073

Key Facts

- **98.44%** chose the following options :
  - Strongly Agree

The screen graphics were clear and easy for me to see.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**Strongly Agree**	**36**	**56.25%**	
2.	Agree	24	37.50%	
3.	No Opinion	2	3.12%	
4.	Disagree	2	3.12%	
5.	Strongly Disagree	0	0.00%	
	Total	**64**	**100%**	

Key Analytics

Mean	1.531
Confidence Interval @ 95%	[1.357 - 1.706] n = 64
Standard Deviation	0.712
Standard Error	0.089

Key Facts

- **93.75%** chose the following options :
  - Strongly Agree

The layout of the site was logical and easy to use.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**Strongly Agree**	**36**	**56.25%**	
2.	Agree	26	40.62%	
3.	No Opinion	1	1.56%	
4.	Disagree	1	1.56%	
5.	Strongly Disagree	0	0.00%	
	Total	**64**	**100%**	

Key Analytics

Mean	1.484
Confidence Interval @ 95%	[1.333 - 1.636] n = 64
Standard Deviation	0.617
Standard Error	0.077

Key Facts

- **96.88%** chose the following options :
  - Strongly Agree

Using the icons to locate site information was a simple, effective way of finding information.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**Strongly Agree**	**32**	**50.79%**	
2.	Agree	24	38.10%	
3.	No Opinion	6	9.52%	
4.	Disagree	1	1.59%	
5.	Strongly Disagree	0	0.00%	
	Total	**63**	**100%**	

Key Analytics

Mean	1.619
Confidence Interval @ 95%	[1.439 - 1.799] n = 63
Standard Deviation	0.728
Standard Error	0.092

Key Facts

- **88.89%** chose the following options :
  - Strongly Agree

The website was user friendly.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**Strongly Agree**	**35**	**55.56%**	
2.	Agree	28	44.44%	
3.	No Opinion	0	0.00%	
4.	Disagree	0	0.00%	
5.	Strongly Disagree	0	0.00%	
	Total	**63**	**100%**	

Key Analytics

Mean	1.444
Confidence Interval @ 95%	[1.321 - 1.568] n = 63
Standard Deviation	0.501
Standard Error	0.063

Key Facts

- **100%** chose the following options :
  - Strongly Agree

Prompts explaining how to use the site were clear.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**Strongly Agree**	**35**	**54.69%**	
2.	Agree	24	37.50%	
3.	No Opinion	3	4.69%	
4.	Disagree	2	3.12%	
5.	Strongly Disagree	0	0.00%	
	Total	**64**	**100%**	

Key Analytics

Mean	1.562
Confidence Interval @ 95%	[1.383 - 1.742] n = 64
Standard Deviation	0.732
Standard Error	0.091

Key Facts

- **92.19%** chose the following options :
  - Strongly Agree

I found the information relevant to me.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	25	39.06%	
2.	**Agree**	**26**	**40.62%**	
3.	Neutral	10	15.62%	
4.	Disagree	3	4.69%	
5.	Strongly Disagree	0	0.00%	
	Total	**64**	**100%**	

Key Analytics

Mean	1.859
Confidence Interval @ 95%	[1.651 - 2.068] n = 64
Standard Deviation	0.852
Standard Error	0.107

Key Facts

- **79.69%** chose the following options :
  - Agree

The site provided information that is useful.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**Strongly Agree**	**30**	**46.88%**	
2.	Agree	30	46.88%	
3.	Neutral	3	4.69%	
4.	Disagree	1	1.56%	
5.	Strongly Disagree	0	0.00%	
	Total	**64**	**100%**	

Key Analytics

Mean	1.609
Confidence Interval @ 95%	[1.448 - 1.770] n = 64
Standard Deviation	0.657
Standard Error	0.082

Key Facts

- **93.75%** chose the following options :
  - Strongly Agree

In my opinion, this is an ideal website for providing me with health information.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	22	34.38%	
2.	**Agree**	**26**	**40.62%**	
3.	Neutral	11	17.19%	
4.	Disagree	4	6.25%	
5.	Strongly Disagree	1	1.56%	
	Total	**64**	**100%**	

Key Analytics

Mean	2.000
Confidence Interval @ 95%	[1.765 - 2.235] n = 64
Standard Deviation	0.959
Standard Error	0.120

Key Facts

- **75%** chose the following options :
  - Agree
  - Strongly Agree
- Least chosen option **1.56%** :

I will return to this site for health information.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	18	28.12%	
2.	**Agree**	**29**	**45.31%**	
3.	Neutral	11	17.19%	
4.	Disagree	6	9.38%	
5.	Strongly Disagree	0	0.00%	
	Total	**64**	**100%**	

Key Analytics

Mean	2.078
Confidence Interval @ 95%	[1.854 - 2.302] n = 64
Standard Deviation	0.914
Standard Error	0.114

Key Facts

- **73.44%** chose the following options :
  - Agree

I am likely to say positive things to others about the usefulness of the site.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	16	25.00%	
2.	**Agree**	**34**	**53.12%**	
3.	Neutral	7	10.94%	
4.	Disagree	6	9.38%	
5.	Strongly Disagree	1	1.56%	
	Total	**64**	**100%**	

Key Analytics

Mean	2.094
Confidence Interval @ 95%	[1.864 - 2.324] n = 64
Standard Deviation	0.938
Standard Error	0.117

Key Facts

- **78.12%** chose the following options :
  - Agree
  - Strongly Agree
- Least chosen option **1.56%** :

I will recommend this site for accessing health information.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	18	28.12%	
2.	**Agree**	**32**	**50.00%**	
3.	Neutral	8	12.50%	
4.	Disagree	5	7.81%	
5.	Strongly Disagree	1	1.56%	
	Total	**64**	**100%**	

Key Analytics

Mean	2.047
Confidence Interval @ 95%	[1.818 - 2.275] n = 64
Standard Deviation	0.933
Standard Error	0.117

Key Facts

- **78.12%** chose the following options :
  - Agree
  - Strongly Agree
- Least chosen option **1.56%** :

While on this site, I accessed information in addition to the designated sections.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	8	12.50%	
2.	Agree	17	26.56%	
3.	Neutral	8	12.50%	
4.	**Disagree**	**26**	**40.62%**	
5.	Strongly Disagree	5	7.81%	
	Total	**64**	**100%**	

Key Analytics

Mean	3.047
Confidence Interval @ 95%	[2.746 - 3.348] n = 64
Standard Deviation	1.227
Standard Error	0.153

Key Facts

- **67.19%** chose the following options :
  - Disagree
  - Agree
- Least chosen option **7.81%** :

I will return to this site for health information.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	14	21.88%	
2.	**Agree**	**33**	**51.56%**	
3.	Neutral	10	15.62%	
4.	Disagree	6	9.38%	
5.	Strongly Disagree	1	1.56%	
	Total	**64**	**100%**	

Key Analytics

Mean	2.172
Confidence Interval @ 95%	[1.943 - 2.401] n = 64
Standard Deviation	0.935
Standard Error	0.117

Key Facts

- **73.44%** chose the following options :
  - Agree
  - Strongly Agree
- Least chosen option **1.56%** :

I will add this site to my 'Favorites.'

Frequency Analysis

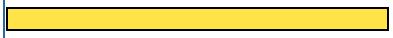
	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	Strongly Agree	15	23.44%	
2.	Agree	14	21.88%	
3.	Neutral	13	20.31%	
4.	**Disagree**	**17**	**26.56%**	
5.	Strongly Disagree	5	7.81%	
	Total	**64**	**100%**	

Key Analytics

Mean	2.734
Confidence Interval @ 95%	[2.416 - 3.053] n = 64
Standard Deviation	1.300
Standard Error	0.163

Key Facts

- **50%** chose the following options :
  - Disagree
  - Strongly Agree
- Least chosen option **7.81%** :

Information Retention Post-Test (IRO)				
Overall Matrix Scorecard				
	Question	Count	Score	True False Do Not Know
1.	Cancer is a disease where cells divide and grow normally.	62	1.935	
2.	Colorectal cancer is responsible for fewer deaths each year than any other type of cancer.	61	1.967	
3.	Metastatic colorectal cancer is cancer that has spread from the colon or rectum to another part of the body.	61	1.098	
4.	If colorectal cancer is found early, it is very likely to be cured.	62	1.048	
5.	Polyps are growths in the colon and rectum that are usually benign.	61	1.164	
6.	Your risk of colorectal cancer goes up if you spend too much time in the sun.	61	2.066	
7.	You may reduce your risk factors for colorectal cancer by eating a diet low in saturated fat and increasing the amount of exercise you get.	62	1.161	
8.	Having one or more of the risk factors for colorectal cancer means that you will develop the disease.	62	2.016	
		Average	**1.557**	

Cancer is a disease where cells divide and grow normally.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	True	8	12.90%	
2.	**False**	**50**	**80.65%**	
3.	Do Not Know	4	6.45%	
	Total	**62**	**100%**	

Key Analytics

Mean	1.935
Confidence Interval @ 95%	[1.826 - 2.045] n = 62
Standard Deviation	0.439
Standard Error	0.056

Key Facts

- **93.55%** chose the following options :
  - False
  - True
- Least chosen option **6.45%** :

Colorectal cancer is responsible for fewer deaths each year than any other type of cancer.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	True	5	8.20%	
2.	**False**	**53**	**86.89%**	
3.	Do Not Know	3	4.92%	
	Total	**61**	**100%**	

Key Analytics

Mean	1.967
Confidence Interval @ 95%	[1.876 - 2.058] n = 61
Standard Deviation	0.364
Standard Error	0.047

Key Facts

- **95.08%** chose the following options :
  - False
  - True
- Least chosen option **4.92%** :

Metastatic colorectal cancer is cancer that has spread from the colon or rectum to another part of the body.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**True**	**58**	**95.08%**	
2.	False	0	0.00%	
3.	Do Not Know	3	4.92%	
	Total	**61**	**100%**	

Key Analytics

Mean	1.098
Confidence Interval @ 95%	[0.989 - 1.208] n = 61
Standard Deviation	0.436
Standard Error	0.056

Key Facts

- **100%** chose the following options :
  - True

If colorectal cancer is found early, it is very likely to be cured.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**True**	**60**	**96.77%**	
2.	False	1	1.61%	
3.	Do Not Know	1	1.61%	
	Total	**62**	**100%**	

Key Analytics

Mean	1.048
Confidence Interval @ 95%	[0.978 - 1.119] n = 62
Standard Deviation	0.282

Key Facts

- Least chosen option **1.61%** :

Polyps are growths in the colon and rectum that are usually benign.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**True**	**54**	**88.52%**	
2.	False	4	6.56%	
3.	Do Not Know	3	4.92%	
	Total	**61**	**100%**	

Key Analytics

Mean	1.164
Confidence Interval @ 95%	[1.041 - 1.287] n = 61
Standard Deviation	0.489
Standard Error	0.063

Key Facts

- **95.08%** chose the following options :
  - True
  - False
- Least chosen option **4.92%** :

Your risk of colorectal cancer goes up if you spend too much time in the sun.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	True	1	1.64%	
2.	**False**	**55**	**90.16%**	
3.	Do Not Know	5	8.20%	
	Total	**61**	**100%**	

Key Analytics

Mean	2.066
Confidence Interval @ 95%	[1.988 - 2.143] n = 61
Standard Deviation	0.309
Standard Error	0.040

Key Facts

- **98.36%** chose the following options :
  - False
  - Do Not Know
- Least chosen option **1.64%** :

You may reduce your risk factors for colorectal cancer by eating a diet low in saturated fat and increasing the amount of exercise you get.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	**True**	**56**	**90.32%**	
2.	False	2	3.23%	
3.	Do Not Know	4	6.45%	
	Total	**62**	**100%**	

Key Analytics

Mean	1.161
Confidence Interval @ 95%	[1.032 - 1.290] n = 62
Standard Deviation	0.518
Standard Error	0.066

Key Facts

- **96.77%** chose the following options :
  - True
  - Do Not Know
- Least chosen option **3.23%** :

Having one or more of the risk factors for colorectal cancer means that you will develop the disease.

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.	True	2	3.23%	
2.	**False**	**57**	**91.94%**	
3.	Do Not Know	3	4.84%	
	Total	**62**	**100%**	

Key Analytics

Mean	2.016
Confidence Interval @ 95%	[1.945 - 2.087] n = 62
Standard Deviation	0.286
Standard Error	0.036

Key Facts

- **96.77%** chose the following options :
  - False
  - Do Not Know
- Least chosen option **3.23%** :

Frequency Analysis

	Answer	Count	Percent	20% 40% 60% 80% 100%
1.		**34**	**100.00%**	
	Total	**34**	**100%**	

Key Analytics

Mean	1.000
Confidence Interval @ 95%	[1.000 - 1.000] n = 34
Standard Deviation	0.000

APPENDIX D: RECAP OF RESPONSES

Table 14: Survey Recap
CSE Measures

Statement	Respondents' Opinions	# Responses at Each Level	Total Count	%
1. As far as the Internet goes, I am competent.	Agree	91	116	78.45
	No Opinion/Neutral	13		11.21
	Disagree	12		10.34
2. I find working on the Internet frustrating.	Agree	13	117	11.11
	No Opinion/Neutral	15		12.82
	Disagree	89		76.07
3. I am confident in my abilities to use the Internet to find HI.	Agree	89	116	76.72
	No Opinion/Neutral	21		18.10
	Disagree	6		5.17
4. I waste time struggling with different sites to find information.	Agree	35	116	30.18
	No Opinion/Neutral	16		13.79
	Disagree	65		56.03
5. I find using the Internet for HI easy.	Agree	73	116	62.93
	No Opinion/Neutral	21		18.10
	Disagree	22		18.97

In table Strongly Agree and Agree are combined as Agree; Strongly Disagree and Disagree are combined as Disagree

Table 15: Attitude – Seniors toward Internet HI

Statement	Respondents' Opinions	# Responses at Each Level	Total Count	%
1. I find the Internet gets in the way of learning HI.	Agree	9	117	7.69
	No Opinion/Neutral	12		10.26
	Disagree	96		82.05
2. Using the Internet makes learning about health information more interesting.	Agree	100	118	84.75
	No Opinion/Neutral	17		14.41
	Disagree	1		.85
3. I always seem to have problems when trying to find HI on the Internet.	Agree	15	118	12.71
	No Opinion/Neutral	15		12.71
	Disagree	88		74.58
4. Computer/Internet jargon baffles me and distracts from finding health information.	Agree	12	118	10.17
	No Opinion/Neutral	11		9.32
	Disagree	95		80.51
5. The Internet is a good aid to learning about HI.	Agree	110	118	93.22
	No Opinion/Neutral	5		4.24
	Disagree	3		2.54
6. The Internet helps me to save a lot of time to find HI.	Agree	98	117	83.76
	No Opinion/Neutral	15		12.82
	Disagree	4		3.42

In table, Strongly Agree and Agree are combined as Agree; Strongly Disagree and Disagree are combined as Disagree

Table 16: Attitude/Perception of Site after Using - Seniors toward Internet HI

Statement	Respondents' Opinions	# Responses at Each Level	Total Count	%
1. I found the information relevant to me.	Agree	50	63	79.37
	No Opinion/Neutral	10		15.87
	Disagree	3		4.76
2. The site provided information that is useful.	Agree	59	63	93.65
	No Opinion/Neutral	3		4.76
	Disagree	1		1.59
3. In my opinion this is an ideal website for providing me with HI.	Agree	47	63	74.60
	No Opinion/Neutral	11		
	Disagree	5		
4. I will return to this site for HI.	Agree	46	63	73.02
	No Opinion/Neutral	11		17.46
	Disagree	6		9.52
5. I am likely to say positive things to others about the usefulness of the site.	Agree	49	63	77.78
	No Opinion/Neutral	7		11.11
	Disagree	7		11.11
6. I will recommend this site for accessing HI.	Agree	49	63	77.78
	No Opinion/Neutral	8		12.70
	Disagree	6		9.53
7. While on this site, I accessed information in addition to the designated sections.	Agree	24	63	38.10
	No Opinion/Neutral	8		12.70
	Disagree	31		49.21
8. I will return to this site for HI.	Agree	46	63	73.02
	No Opinion/Neutral	10		15.87
	Disagree	7		11.11
9. I will add this site to my "Favorites."	Agree	28	63	44.44
	No Opinion/Neutral	13		20.63
	Disagree	22		34.92

In table, Strongly Agree and Agree are combined as Agree; Strongly Disagree and Disagree are combined as Disagree

Table 17: Content Measure - Pre-assessment / Post-assessment

Question	Pre-assessment Participants	Correct response	Correct %	Post-assessment Participants	Correct response	Correct %
1. Cancer is a disease where cells divide and grow normally.	119	98	82.35	61	49	80.33
2. CC us responsible for fewer deaths each year than other C.	119	88	73.95	60	52	86.67
3. Metastatic CC is C that has spread from the colon or rectum to another part of the body.	119	93	78.15	60	57	95.00
4. If CC is found early, it is very likely to be cured.	119	110	92.44	61	59	96.72
5. Polyps are growths in the colon and rectum that are usually benign.	119	101	84.87	60	53	88.33
6. Your risk of CC goes up if you spend too much time in the sun.	119	87	73.11	60	54	90.00
7. You may reduce your risk factors for CC by eating a diet low in saturated fat and increasing the amount of exercise you get.	119	94	78.99	61	55	90.16
8. Having one or more of the risk factors for CC means that you will develop the disease.	119	98	82.35	61	56	91.80

CC is Colorectal Cancer.

In the table, Strongly Agree and Agree are combined as Agree and Strongly Disagree and Disagree are combined as Disagree.

Table 18: Site Measure (Usability) – Primary Responses HFE / Seniors

Topics	HFE	Respondents' Opinions	# responds to level	Total # respondents	%
Titles clear which section viewing	Agree	Agree	63	63	100.00
	No Opinion	No Opinion	-		-
	Disagree	Disagree	-		-
Text easy to see and read	Agree	Agree	62	63	98.41
	No Opinion	No Opinion	1		1.59
	Disagree	Disagree	-		-
Language easy to understand	Agree	Agree	62	63	98.41
	No Opinion	No Opinion	1		1.59
	Disagree	Disagree	-		-
Graphics clear and easy to see	Agree	Agree	59	63	93.65
	No Opinion	No Opinion	2		3.17
	Disagree	Disagree	2		3.17
Layout of site logical and easy to use	Agree	Agree	61	63	96.83
	No Opinion	No Opinion	1		1.59
	Disagree	Disagree	1		1.59
Icons were simple for finding information	Agree	Agree	55		88.71
	No Opinion	No Opinion	6		9.68
	Disagree	Disagree	1	62	1.61
Site user friendly	Agree	Agree	62	62	100.00
	No Opinion	No Opinion	-		
	Disagree	Disagree	-		
Prompts to use site clear	Agree	Agree	59	63	93.65
	No Opinion	No Opinion	2		3.17
	Disagree	Disagree	2		3.17

APPENDIX E: STATISTICS

Table 19: General Linear Model: Descriptive Statistics (Question 1)

Descriptive Statistics

	Group	Mean	Std. Deviation	N
U2	HFP	1.5000	.57735	4
	SEN	1.3387	.47713	62
	Total	1.3485	.48014	66
U3	HFP	1.5000	.57735	4
	SEN	1.3387	.51034	62
	Total	1.3485	.51118	66
U4	HFP	1.5000	.57735	4
	SEN	1.3548	.48237	62
	Total	1.3636	.48473	66
U5	HFP	2.2500	1.25831	4
	SEN	1.5161	.71842	62
	Total	1.5606	.76719	66
U6	HFP	1.2500	.50000	4
	SEN	1.4677	.61983	62
	Total	1.4545	.61223	66
U7	HFP	1.7500	.50000	4
	SEN	1.6129	.73227	62
	Total	1.6212	.71823	66
U8	HFP	1.7500	.50000	4
	SEN	1.4355	.49987	62
	Total	1.4545	.50175	66
U9	HFP	2.2500	.95743	4
	SEN	1.5484	.73946	62
	Total	1.5909	.76414	66

Table 20: HFPs' Usability Rating

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
U	4	8.00	19.00	13.7500	2.39357	4.78714	22.917
U_Ave	4	1.00	2.38	1.7188	.29920	.59839	.358
Valid N (listwise)	4						

A follow-up pairwise comparison revealed near significant effects of groups for items U5 (Prompts) ($F_{1,64}$=3.574, p = .063) and U9 (Graphics) ($F_{1,64}$ = 3.279, p=.075), no other items approached significance. U5 was “the prompts explaining how to use the site were clear.” U9

was “the screen graphics are clear and easy to see.” The ratings overall were favorable in assessing usability of the site.

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