The effect of text messaging alerts upon testicular self-examination (tse) adherence

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THE EFFECT OF TEXT MESSAGING ALERTS UPON TESTICULAR SELF-EXAMINATION (TSE) ADHERENCE

by

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A thesis submitted in partial fulfillment of the requirements for the Honors in the Major Program in Health Sciences in the College of Health and Public Affairs and in The Burnett Honors College at the University of Central Florida Orlando, Florida

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ABSTRACT

Based on Kim Witte’s proven Extended Parallel Process Model, a mobile communication system was developed in which men were sent reminders about their health. This study focused on reminding men about testicular self-examination (TSE), a proactive behavior used to detect testicular cancer, through the use of text messaging. A cohort of 75 men were recruited for this study and placed into one of four groups. All participants were provided with information concerning TSE and told to perform the exam monthly; two of the four groups were sent reminders via text message while the other two groups were told once about the behavior. An original 30-item survey was used to measure intention.

Proper data analysis could not be performed due to an attrition rate of 71%. Nonetheless, a significant relationship was observed between pre- and post-test adherence as reported by the participants. In addition, the measurement tool was assessed and determined to be useful in measuring intention to perform TSE. Internal consistency measures were reported as 0.672 and 0.626, both of which would have been higher with a larger sample size. While further research and analysis is recommended, this study has laid a foundation for a way to communicate with young men about their health.
DEDICATION

For my parents, you gave me the ability to chase after my big dreams because, “What is the purpose of a dream if you don’t pursue it?” Thank you for your love and support and for never discouraging my ambitious spirit.

For my friends who continuously encouraged me and never let me quit. Thank you for believing in me when I didn’t believe in myself.

For the Men’s Health Initiative, thank you for all the support and help with this project.
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INTRODUCTION

PREVALENCE

Testicular cancer is the most prevalent form of cancer among 15 to 35 year-old men, otherwise deemed the ‘at-risk’ demographic (McCullagh, Lewis, & Marlow, 2005; Powe et al., 2007). Although incidence rates are low compared to other cancers (about 1-2% of all male cancers), they continue to increase and are a leading cause of death among at-risk males (Wynd, 2002; Brenner et al., 2003; Steadman & Quine, 2004; Rudberg et al., 2005). The American Cancer Society estimated that approximately 8000 new cases and 400 deaths resulted from testicular cancer in 2010. Walschaerts et al. (2008) note that incidence rates among at-risk men increased over 50% over the past 40 years with the at-risk demographic demonstrating the greatest overall increase. Due to the increase in number of cases among at-risk males, there is a general trend in men’s health advocacy work that focuses on prevention and persuading men to take a more active role in conducting preventative behaviors (e.g., testicular self-examination [TSE]).
COMMUNICATION BARRIER

Some influential variables upon male adherence of TSE include knowledge/awareness (Rovito et al., 2011), fear (Gast & Peak, 2010), and efficacy (McClenahan et al., 2007). ‘Perceived masculinity’ has recently been garnering much attention as a major barrier for men to perform TSE or comply to undergo a colonoscopy and/or DRE (Vargas-Bustamante, 2010). Perceived masculinity may assist in repressing emotions, failing to report symptoms of disease, suppressing the desire to seek help from others (Nicholas, 2000), increasing the hypersensitivity of men in feeling ‘unmanly’, (MacNaughton, 2008) and thus possibly lending to the trend of rising morbidity and mortality rates.

Creating effective messages to encourage health preventive behaviors such as TSE is critical to early detection of testicular cancer. One strategy used in health marketing with mixed success has been the concept of ‘segmentation’ (Noar et al., 2007) of a particular sample in smaller sub-samples. This technique segments the sample into groups with a particular variable in common, either demographic, socio-cultural, medical, or any other identifier. However, it has not been used effectively in promoting TSE in young men.

Most studies generally suggest that delivery of testicular cancer preventative services must improve (Cronholm et al.,
2009), or that educators are enthusiastic about promoting testicular cancer and TSE information (Evans, Simons, & Wardle, 2010), but most studies do not indicate their methods of information dissemination, let alone any comprehensive plan to test message effectiveness. Consequently, this overwhelming body of descriptive research leaves much of the field virtually unobserved in terms of actual behavioral manipulation through intervention research.

PURPOSE

This thesis aims to showcase the effectiveness of text messaging as a means to promote TSE among men. Using Steadman and Quine’s (2004) ‘implementation intentions’ research on the effectiveness of reminder systems and TSE adherence, as well as Rovito et al.’s, (2011) assertion that men prefer private communication on TSE promotion than public; private messages are to be used as the reminder system and will be designed based on Witte’s (1992) Extended Parallel Process Model. Using Witte’s (1992) model, the messages will induce a threat while providing high efficacy to induce danger control as opposed to fear. Further, we hypothesize that the use of text messaging will increase TSE adherence among men. This private, reoccurring reminder system will encourage men to conduct the procedure according to the recommendation of once-a-month performance, at
minimum. This study aims to test the accuracy and consistency of original instrumentation through pilot testing of the tool.

SPECIFIC AIMS AND HYPOTHESIS

Research Question
Can the use of socially mediated messages (specifically, text messaging) promote adherence to TSE among college age men?

Specific Aims/Hypothesis
SA1: To develop a communication system, using mHealth principles, which will be used to deliver monthly TSE informational reminders tailored specifically to college men.
SA2: To carry out a pilot study to test accuracy and consistency of original instrumentation which will be of further use in the assessment of a mobile communication system used to deliver monthly TSE informational reminders tailored specifically to college age men.

H1: Those men receiving monthly text messages will report more frequent TSE adherence than men who received only baseline communication.

H2: Those men receiving bi-weekly text messages will report more frequent TSE adherence then men that received only baseline communication.
H3: Those men receiving bi-weekly text messages will report more frequent TSE adherence than men who received monthly text messages.

H4: Those men who attend the informational seminar (baseline communication) will report more frequent TSE adherence than men who received no information regarding TSE regardless of message reminders.
LITERATURE REVIEW

TESTICULAR CANCER: RISING RISK

Testicular cancer is the most prevalent form of cancer among men aged 15-35 (Barling & Lehmann, 1999). Incidence rates are low compared to other cancers (about 1-2% of all male cancers), yet continue to increase and serve as a leading cause of death among 15-54 year-olds (Khadra & Oakeshott, 2002). The American Cancer Society (2008) estimates 8,090 new cases and 380 deaths will result from testicular cancer. Incidence rates among at-risk men increased 50%+ over the past 40 years with males aged 15-35 years demonstrating the greatest overall increase (Walschaerts et al., 2008). Due to the aggressive nature of the disease, researchers state that early detection is of utmost importance to overall survival (Tani, 2002; Cox et al., 2005). The lack of testicular cancer information dissemination limits prevention behaviors (Lechner et al., 2002), contributing to a 50% diagnosis rate post-diaspora from the testes (Trumbo, 2004), and thus increasing mortality rates from the disease. One of the most significant concerns with testicular cancer is ‘years of potential life loss’ as those most affected are under 35 years of age (Walschaerts et al., 2008).
Primary health care providers chiefly perform testicular cancer screenings, but there is little evidence demonstrating long-term sustainability (or adherence) of prevention behaviors (Cook, 2000; Hergenroeder, Kozinetz, & Kelder, 2003; Kleier, 2004; Ward et al., 2005; Horowitz et al., 2006). This fact has held true throughout the past few decades. For example, Vaz, Best, and Davis (1988) indicated that males were not properly counseled by their physicians about testicular cancer risks and prevention techniques, noting that only 2% of males report receiving information on how to properly conduct TSE. Nearly 20 years later, Rudberg et al., (2005) state that only 5 out of 727 (0.6%) males report learning TSE from their primary care physician (PCP), thereby demonstrating that little has been done to promote testicular cancer screening during PCP visits. The authors discuss the role that school nurses and even military examinations can possibly serve as alternate sources for testicular cancer screenings outside of their PCP. But, again, there is very little evidence clearly demonstrating long-term adherence.

A LACK OF KNOWLEDGE AND AWARENESS

There is a reported history of a wide TSE knowledge gap among men in terms of TSE awareness. Barling and Lehmann (1999)
note that 83% of pre-test participants did not perform the recommended once-a-month TSE. Best et al. (1996) state that although up to 31% of at-risk males indicate knowledge of TSE only 18% report doing TSE. Wardle et al. (1994) report less than 15% of participating males had knowledge of TSE with only 3% reporting regular practice. Katz et al. (1995) note that 9% of surveyed males knew of their risk to develop testicular cancer with 19% reporting regular TSE practice. Ward et al. (2005) indicate that only 10.3% of their sample group performed TSE regularly. One particular deviation from the norm is McClenahan et al.’s (2007) claim that 61% of participants reported that they knew how to perform TSE; however, this is offset by the fact that only approximately 10% reported practicing the recommended once-a-month exam. These trends are repeated across most existing TSE studies (Tani, 2002).

Blesch (1986), Katz et al. (1995), Tani (2002), and Singleton (2008) highlight the reasons men have not practiced TSE over the past 25 years. Lack of knowledge about testicular cancer risks and how to perform TSE, lack of perceived severity of testicular cancer, lack of perceived susceptibility to testicular cancer, forgetfulness, lack of time, fear, embarrassment, and upholding their maleness are all listed as top reasons why TSE is not performed among the vast majority of
men. Although most men do not practice TSE, for any of the aforementioned reasons, Wynd (2002) indicates that 9 out of 10 cases of testicular cancer are self-discovered. However, a primary issue with testicular cancer is that many of these cases are found in advanced stages. Wynd (2002) note that 15% to 20% of testicular tumors have metastasized by the time they discovered. Men are discovering testicular lumps by themselves, but well after Stage I cancer and commonly once it has spread to other organs.

TESTICULAR SELF EXAMINATION: GAPS IN RESEARCH

Men’s Health Scholars suggest that irregular screenings from primary health care providers promotes self-screening for detecting testicular cancer due to its convenience, privacy, and potential for repeated performance (Horowitz, Reinert, & Caldamone, 2006; Kleier, 2004; Hergenroeder, Kozinetz, & Kelder, 2003; Wynd, 2002). The American Cancer Society (2008) recommends that men should conduct TSE at least once a month due to the rapid nature of testicular carcinoma growth. Although some researchers, including the US Preventative Task Force Service, question TSE effectiveness due to possible increases in anxiety and a lack of clinical trials demonstrating its mortality reduction-powers (Goldbloom, 1985; Dearnaley, Huddart, & Horwich, 2001), the majority of men’s health promotional
research calls for increased publicity of TSE. However, TSE is seldom taught and rarely practiced (Rudberg, Nilsson, Wikblad, & Carlsson, 2005). Even if men are educated on TSE, long-term compliance, as stated previously, has not been observed.

Existing interventions fail to report long-term, sustainable TSE performance among participating males even when exposed to promotional messages (Steadman & Quine, 2004; McCullagh, Lewis & Marlow, 2005). A lack of sustainable TSE performance post-intervention indicates either a content communication flaw or a contextual theoretical weakness in how the specific communication was conveyed. Although Lance Armstrong’s high-profile testicular cancer case brought much attention to TSE and the importance of screening, thus producing an increase in knowledge and awareness, actual TSE behaviors did not show any significant increase (Trumbo, 2004; Ward et al., 2005). This suggests that content delivery, not the content itself, may be the source of the problem in terms of consistent, long-term TSE adherence.

The failure of men to consistently perform TSE post-intervention may suggest weaknesses in the study designs and their theoretical foundations. Although some studies claim initial success increasing knowledge and intention to perform TSE (Lechner et al., 2002; McCullagh, Lewis & Marlow, 2005),
there are no significant trends in TSE sustainability. This lends to the argument that there are significant factors in TSE promotional message design not emphasized and properly tested for their influence upon behaviors. Robertson et al. (2008) indicate that larger-scaled, more comprehensive studies are needed to effectively test promotional campaigns.

CREATING MESSAGES

Creating effective messages to encourage health preventive behaviors, such as TSE, is critical to early detection of testicular cancer. One strategy used in health marketing with mixed success has been the concept of segmentation (Noar et al., 2007), which segments the sample into groups with a particular variable in common, though it has not been used effectively in promoting TSE in young men. Most studies generally suggest that delivery of testicular cancer preventative services must improve (e.g., Cronholm et al., 2009), or that educators are enthusiastic about promoting testicular cancer and TSE information (e.g., Evans, Simons, & Wardle, 2010), but most studies do not indicate their methods of information dissemination, let alone any comprehensive plan to test message effectiveness. Consequently, this overwhelming body of descriptive research leaves much of the field virtually
unobserved in terms of actual behavioral manipulation, particularly long-term behavioral change.

Socially Mediated Messages

With new advancements in social media, the barriers limiting communication are disintegrating. Social media plays an ever-influential role in how people correspond with each other. Health providers, as well as patients, are now using social media as a means to instantaneously communicate regarding personal health care (Tucker, 2011).

The dearth of studies linking testicular cancer prevention to mobile phone technology and eventually social media produces a need to investigate the possible relationship. Research suggests mobile phone technology, as a means for health behavior modification is an effective method of communicating behavior change (Cole-Lewis & Kershaw, 2010). Further, Cole-Lewis and Kershaw (2010) suggest that 96% of countries in the world have mobile phone networks, which includes the use of text messaging services. As almost every phone model is capable of executing text services, and a vast majority of the population has access to said technology, a cost effective and convenient mode of reaching a large audience is created.

This technology is also user-friendly, meaning all populations and subsequent subgroups may be reached with ease.
Tucker (2011) has shown that a large audience of people can indeed be efficiently and rapidly communicated with in emergent and non-emergent situations. This principle may be effectively applied to using text messaging to reach a large population of men concerning their health.

Further, Cole-Lewis and Kershaw’s research focuses on the use of text messaging due to the emergence and popularity of Mobile Health (mHealth). Eight of the twelve studies in the Cole-Lewis and Kershaw (2010) review correlate a short-term effect in text message use and behavior change, none of which are specific to testicular cancer. While current information is limited, research supports that mobile phone technology and social media is in fact changing the way information is received. Thus, the use of text messaging as an intervention in health behavior change is equitable. In addition, current information warrants that further studies be conducted in other fields, including cancer awareness. This study aims to determine the effectiveness of communicating with patients about testicular health through text messaging.

Extended Parallel Process Model (EPPM)

Witte’s (1992) EPPM advocates both high threat and high efficacy messages as the most effective in altering behaviors and decision-making processes. The EPPM stresses that fear
(emotion) leads to message rejection and perceived threat and efficacy (cognition) leads to message acceptance. Further, individuals faced with a threat perform either danger control (adaptive) or fear control (maladaptive). Danger control seeks to reduce the risk whereas fear control seeks to reduce the perceived risk. In order for an individual to perform adaptive health behavior decisions, an individual must perceive the availability of an opportunity to reduce the risk (response efficacy) as well as the self-efficacy to perform risk reduction behaviors. If both are not present, the individual chooses fear control methods, which promotes maladaptive health behaviors. This model has been used extensively over the years with very successful results in producing behavioral changes (Witte et al., 1998; Witte, 1998; Witte, 1992; Roberto et al., 2000; Murray-Johnson et al., 2004; Gore & Bracken, 2005).

This study will approach the EPPM in two ways using the message reminders. One approach is to address response efficacy, which is the availability of an opportunity to reduce the risk, while the other is to address operational efficacy, which we have defined as the ability of the procedure to identify the risk. We recognize with TSE that operational efficacy is indeed limited. Previous literature acknowledges the fact that awareness of the procedure as well as the individuals’ ability
to conduct the procedure properly is limited (Rovito et al., 2011). To limit this, we will address the ability to properly perform TSE at the seminar and all men will be given literature for future reference. In addition, proper procedure will be reinforced in the text message reminders.

High Threat/High Efficacy Message Design

The EPPM suggests that high threat (severity and vulnerability) and high efficacy (response and self-efficacy) messages are most influential in changing health behaviors. Therefore, abiding by message design theory (Robertson et al., 2008; Sethares & Elliot, 2004; Myers et al., 2007; Hirst et al., 1997), both experimental groups will need to have a high threat/high efficacy message designed specifically for them in order to achieve behavior change. Although Morman (2000) found significant increases in intention to perform TSE among men exposed to the EPPM’s recommendations of high threat/high efficacy messages, there have been no published reports of using messages tailored to personality promoting long-term TSE adherence.
METHODOLOGY

STUDY DESIGN

A quasi-experimental design was utilized to test high threat/high efficacy messages (Witte, 1992) promoting long-term TSE adherence among a cohort of University of Central Florida males via text messaging. This study expands upon Morman’s (2000) success in increasing intention to perform TSE via high threat/high efficacy messages. This study’s aim was to understand how participant males perceive threat-driven messages surrounding testicular cancer and TSE via text messaging, and if these messages are powerful enough to alter the decision-making process by repetition of the message over the course of the month. Essentially, the research would demonstrate that a private reminder-system for messages would increase the likelihood of men to perform TSE. We aimed to assess said system’s effectiveness.

Study Phases

There were two phases to the study design (see Figure 1): sampling/baseline communication phase (Phase 1) and experimental phase (Phase 2).

Phase 1 included the sampling and randomization of 75 participants and their subsequent placement into one of four experimental groups. We required that selected, willing
participants offer their phone number to take part in the study. Three of the four test groups were asked to participate in an hour-long educational seminar, hosted by the Men’s Health Initiative, regarding TSE. The test group left out of the seminar served as the control group. The seminar was offered at three different times to provide flexibility and ample opportunity for participants to attend. Prior to the presentation, an original primary survey was distributed on site to the three test groups attending, which participants completed before participating in the seminar. The control group also received this primary survey, it was taken in person at the time which they received their educational materials. Pamphlets designed from the American Cancer Society’s recommendation on TSE were given as the educational material for participants to keep.

Attention was drawn to the top of the primary survey where a four-digit number ID would be written. The ID number was the last four digits of each individual’s phone number. Participants were asked to use this ID as the only form of personal identification, as this was to maintain their anonymity. Additionally, each participant was asked to submit this ID number with any survey submitted either online or in person, or
with any communication with the research team, should it be necessary.

Phase 1 also consisted of a health message design sub-phase, which took place after the educational seminar. Said messages were designed within the parameters of the Extended Parallel Process Model (Witte, 1992), and were employed during Phase 2 of the study. This project was seeking to increase actual TSE performance and long-term intention to continue the behavior via the persuasive nature of the tailored message content. As a result, message content included elements of High Threat/High Efficacy variables as outlined by Witte (1992), which indicates that effective messages induce a damage control response from the recipient.

Phase 2 included three months of intervention implementation. It was during this time that text messages were sent reminding the test subjects in experimental groups one and two to perform their TSE for that given month. Text messages were sent from a study specific e-mail address which only the co-PI had access to. Additionally, at months 2 and 3, secondary surveys were administered to only the two experimental groups to assess TSE adherence.

Month 3 concluded with a second distribution of the primary survey to all four test groups. The primary survey given at this
time was altered to include an item intended to assess long-term intention to continue adherence in performing TSE. Participants were asked for their ID number in order to gain access to the survey.

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<td>Phase II – Experimentation</td>
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<td>• Initiate text messages to experimental groups</td>
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<tr>
<td>• Secondary survey at months 2 and 3–experimental groups only</td>
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<td>• Primary survey at month 3–all groups</td>
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Figure 1

SAMPLE

A convenience sample of 75 University of Central Florida male students aged 18-35 [the at-risk population (Singleton, 2000; McClenahan, 2007)] were sought out to participate in an experiment to determine if text message reminders would increase short and long-term TSE adherence. This population is deemed underserved, as the research on such a population within this topic is relatively limited, with no known studies focused on
the use of mobile messaging to men promoting health and wellness.

The sample was recruited from campus-wide announcements on posted flyers, recruitment outside of the Student Union, presentations at the fraternity houses, and classroom solicitation to take part in the study. The classrooms chosen were those general education classes held in large lectures halls and contained all classification levels of students in order to draw from the most representative sample of university males. The PI and co-PI conducted recruitment and scheduling. Permission was obtained from faculty to make in-class announcements to enroll males into the study. Further, the PI and co-PI recruited participants in the university recreation and wellness center as well as the health center.

A screener survey was given in order to exclude those who currently perform habitual monthly TSE or have been diagnosed with, or treated for, testicular cancer. Of the men considered eligible to partake in the survey, 75 met the requirements to participate. Eligible individuals were randomly sorted into four groups using simple random assignment: (a) control group 1 [terminal communication group, n=13], (b) control group 2 [TSE uneducated group, n = 16], (c) experimental group 1 [monthly text group, n = 23], and (d) experimental group 2 [bi-weekly
text group, n = 22]. Assuming 20% attrition, at the end of Phase 2 sample sizes were expected to be approximately n=12 for each control group and n=20 for each experimental group.

Inclusion/Exclusion Criteria

Race, socioeconomic status, and other personal characteristics did not factor into the sampling of the male students, as the study was seeking to test message effectiveness of TSE promotion regardless of socio-demographic variables. However, those males previously diagnosed and/or treated for testicular cancer, as well as those individual males who are knowledgeable about testicular cancer and/or perform TSE regularly, were screened from the study due to possible knowledge, awareness, or attitudinal differences. Such differences could bring about response biases between groups. Participation in the study was contingent upon access to a reliable mobile device that can receive text messages for the duration of the study. Participants were allowed to use phones or any device that the individual readily carries with them and is capable of receiving text messages which the individual readily accesses as means of receiving the monthly reminders.
Incentive/Compensation

A meal was provided at the information session (baseline communication) in order to incentivize participants to attend the presentation. At the study’s conclusion, participants who submitted responses to all surveys were placed in a drawing using assigned identification numbers to receive a prize of $100 in Knights Cash. The number linking the individual mobile numbers to the surveys tracked survey completion (discussed in depth in Instrumentation and Outcome Measures) and provided a way to maintain anonymity of the winning participant.

INSTRUMENTATION AND OUTCOME MEASURES

Phase 1

A 4-item screener survey was implemented to assess each candidate’s knowledge of testicular cancer and TSE adherence and was designed to exclude those who are not qualified to participate in the study. A 30-item primary survey was then given to those individuals who were eligible to participate in the study. A 5-point Likert scale was used to answer all items in the survey with 1=Strongly Disagree and 5=Strongly Agree. This survey was administered prior to information dissemination at the educational seminar. The primary survey was used as a preliminary review of control group 1, control group 2,
experimental group 1, and experimental group 2 that served as a means of comparison of those selected to evaluate the changes in response throughout the entire study.

The primary survey gauges the participants’ knowledge and awareness of testicular cancer and TSE, while also determining their locus of control (I-Control) in regards to personal health. The participants’ perceived vulnerability in contracting testicular cancer is assessed in the primary survey, along with personal thoughts on the value of health promotion regarding TSE, and the intentions of the participant in actually performing TSE monthly. *See Appendix C for copy of survey*

Five key variables, described above, were identified from the primary survey and used to assess the success of the intervention (developed communication system). The first variable, Knowledge, was included to measure general awareness about the topic, which is basic for measurement tools such as this. The I-Control variable, which is a derivation of locus of control, stems from ‘attitudes’, a variable described in the Theory of Planned Behavior. It has been noted in this theory as being the most predictive of behavior; it is an outcome expectancy measurement. The Value of Health Promotion (VHP) variable is closely linked to I-Control in that it is also an outcome expectancy measurement, although in this sense an
external locus of control would be determinant of the variable. In the Health Belief Model it has been shown that perceived vulnerability is indicative of a person’s behavior. This along with the EPPM’s ‘threat’ component produced the basis for the Vulnerability variable measured using this tool. All the previously mentioned variables serve to predict the dependent variable, Intention. This is consistent throughout the various health theories; multiple variables lead to the prediction of an individual’s intention to perform a behavior.

Baseline communication

At baseline communication, three information sessions were held on the university’s campus to educate all participants equally. Seminars consisted of American Cancer Society recommended material and a lecture informing participants of testicular cancer and proper self-examination technique. Anecdotal data collected at information sessions and quantitative data from initial primary survey distribution was the basis of text message design. Men’s health and health communication experts were used to assist in the content and construct validity of the material used and aided in designing the seminar.
**Message design sub-phase**

Witte’s (1992) high threat high efficacy theory was employed in text message design. Participants were reminded of the gravity of testicular cancer (high threat) while prompted to perform self-examination, which is key in identification and eradication of the disease (response efficacy and self-efficacy). High threat is central in message design to inculcate the need of long-term behavior modification. The threat will not induce fear as this may cause a maladaptive (fear control) response in participants and lead to rejection of the message. Threat was presented in such a way to produce danger control that will lead to risk reduction behaviors (TSE). Both experimental groups 1 and 2 received the same message, which was sent once to group 1 and twice to group 2 per month. By including both a threat and a resolution participants are given reason to self-examine and modify current behaviors. In sending effective messages, which cause participants to consistently perform TSE, it is believed that long-term habits will form.

**Phase 2**

This phase included implementation of a 3-item secondary survey\(^*\) which is intended to assess the effectiveness of the communication via text message. The secondary survey consisted of three items that pertain to the
delivery of the messages. Only participants in experimental groups 1 and 2 received the secondary survey, which was given at months two and three. At the end of Phase 2, the primary survey was given again at month three to all four participant groups. Further, one question asking whether or not the participants have performed TSE in the last month was added to the end of the primary survey. This question is not present in the baseline assessment of the participants due to the screening process of only including men in the study who have never performed, or do not regularly perform (0-2 times within 6 months), TSE. This question will be measured dichotomously.

Message Delivery and Assessment

Text messages were 160 characters, approximately 2 sentences, and included elements from Witte’s (1992) EPPM that emphasizes the use of a high threat/high efficacy design. Due to the time limitations, the dissemination of text messages was carried out every ten days for the experimental group 2. Messages were sent out on the weeks that included at minimum one day of the desired month. This allowed for data to be collected for three months total. Experimental group 2 received two text messages, as opposed to experimental group 1 which received one message, in order to evaluate the effect of message reminder frequency. It is proposed that increased frequency of reminders
will enhance adherence, which if true, will lend credence to the ‘Cues to Action’ construct of the Health Belief Model.

An email account was created to serve as the source of the text messages sent to both experimental groups through Phase 2. Access to the account was granted to the co-PI; the account only functioned for this study’s purposes. The screener survey and the survey given at baseline communication seminar were paper surveys; all other surveys were collected electronically via Qualtrics. An e-mail containing a link to the survey was sent to all participants in order to gain access the online version of the document. Participants provided their assigned participant ID number in the survey as opposed to names; this provided a method of tracking completion of all requirements.

Phase 2 concluded with all participant groups retaking the primary survey at month three to assess any changes in their perceptions of TSE of the key variables from pre- to post-test and to determine long-term adherence to TSE recommendations. Also, all participant groups were asked if they performed TSE within the past month. The secondary survey would not be applicable here since the control groups did not receive text message reminders at any point in the experiment. Therefore, a simple question of whether or not participants performed TSE in
the last month was asked at the end of the primary survey when taken at month three.

ANALYSIS PLAN

Analysis of variance (ANOVA) and t-tests were conducted to determine pre- and post-test differences for changes within participant groups for mean differences in survey responses to key dependent variables: knowledge and awareness of testicular cancer and TSE, locus of control in regards to personal health (I-Control), participant perceived vulnerability in contracting testicular cancer, the value of health promotion regarding TSE, and the intentions of the participant in actually performing monthly TSE.

The dependent variables particularly of importance are intention to perform TSE and self-reported TSE performance. There are four measurements of intention to perform TSE (items 27-30 of the primary survey). A mean was calculated for each participant group for these four items to give each individual an aggregate intention score. This mean was calculated at baseline and at month three for each participant group. Actual performance of TSE was assessed at months two and three for the experimental groups and at month three for the control groups.

TSE adherence was measured as a binary variable based upon the responses to the question of whether or not participants
performed TSE in the past month, in month two (both experimental groups), and at month three (all participant groups). Stepwise linear regression modeling was used to multivariately assess predictors of intent to be screened among the salient variables associated with testicular cancer and TSE including: knowledge and awareness, perceived vulnerability, value of health promotion, and locus of control (I-Control).

The study employed variance analysis using the Test of Homogeneity of Variances. Significance of the Levene Statistic was used to determine if the assumption of equal variances holds true for the study. Additionally, regression analysis was done to determine predictability of the Intention variable. Cronbach’s alpha was then used to determine internal consistency of the instrument used, values of .85 or higher would be accepted to determine consistency.
RESULTS

DEMOGRAPHICS

Of the participants recruited in age range 18-35, a total of 75 men met all conditions necessary to participate in the study. The distribution of ages, as seen in Figure 2, indicates a positive skew with a mean age of 20. The observation is expected of a college population where the majority of students are under the age of 25. This distribution falls within the at risk population defined for the study.

![Pre-Test Age Distribution](image)

Figure 2

At the conclusion of the study a total of 22 participants responded to the final survey; an attrition rate of 71% was
observed. The distribution of ages at the end of the study is seen in Figure 3, showing the largest rate of dropouts coming from the 18-19 age group. Dropout rate for this age group was 86\% as opposed to the 50-60\% attrition rate noted in the other three age groups. With a more normal distribution, the mean age calculated post-test was 20.8.

![Post-Test Age Distribution](image)

**Figure 3**

**ANALYSIS OF VARIANCE**

The 30-item questionnaire was categorized into five composite variables: Knowledge, I-Control, Perceived Value of Health Promotion, Vulnerability, and Intention to Perform TSE. Descriptive statistics (Figure 4) of the five variables from the
pre-test group containing all study participants (n=75) indicates means ranging from 5.047 to 8.140 with Knowledge as the lowest mean and I-Control as the highest.

<table>
<thead>
<tr>
<th>Pre-test Calculated Means (n=75)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>I-Control</td>
</tr>
<tr>
<td>Knowledge</td>
</tr>
<tr>
<td>Vulnerability</td>
</tr>
<tr>
<td>VHP</td>
</tr>
<tr>
<td>Intention</td>
</tr>
</tbody>
</table>

Pre-test variance analysis (Figure 5) was done on the above mean calculations to test for homogeneity. The calculated Levene Statistic values showed no significance in any of the variables. Significance values ranged from 0.071 to 0.624, all indicating insignificance in the variability of observed means, validate the equal variances assumption for this study.

<table>
<thead>
<tr>
<th>Test of Homogeneity of Variances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levene Statistic</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td>I-Control</td>
</tr>
<tr>
<td>Knowledge</td>
</tr>
<tr>
<td>Vulnerability</td>
</tr>
<tr>
<td>VHP</td>
</tr>
<tr>
<td>Intention</td>
</tr>
</tbody>
</table>

Figure 4

Figure 5
Further, a means test was also conducted pre-test on the cohort prior to accounting for attrition, n=75. An ANOVA test was conducted for this study as another means of ensuring homogeneity of groups on the 5 composite variables. Figure 6 indicates no significance in the variance of scores. This finding additionally supports equal variances, in accordance with the previously mentioned analysis.

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IControl</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>9.268</td>
<td>3</td>
<td>3.089</td>
<td>2.506</td>
<td>.066</td>
</tr>
<tr>
<td>Within Groups</td>
<td>87.535</td>
<td>71</td>
<td>1.233</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>96.803</td>
<td>74</td>
<td>1.233</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>2.181</td>
<td>3</td>
<td>.727</td>
<td>.864</td>
<td>.464</td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>23.293</td>
<td>3</td>
<td>7.764</td>
<td>2.180</td>
<td>.098</td>
</tr>
<tr>
<td>Within Groups</td>
<td>252.824</td>
<td>71</td>
<td>3.561</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>276.117</td>
<td>74</td>
<td>3.561</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>3.553</td>
<td>3</td>
<td>1.184</td>
<td>1.206</td>
<td>.314</td>
</tr>
<tr>
<td>VHP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>2.578</td>
<td>3</td>
<td>.859</td>
<td>.734</td>
<td>.535</td>
</tr>
<tr>
<td>Within Groups</td>
<td>83.088</td>
<td>71</td>
<td>1.170</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>85.666</td>
<td>74</td>
<td>1.170</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 6

Means calculations (Figure 7) of pre-test scores from the participants remaining, after attrition was accounted for
(n=22), indicates a range from 5.060 to 8.108 with Knowledge as the lowest mean and I-Control as the highest mean. These values remain consistent with those noted in the pre-test group prior to attrition. Figure 7 also includes post-test scores observed from the cohort after attrition. This displays a range of scores from 6.594 to 8.350 with Knowledge as the lowest calculation and Value of Health Promotion representing the highest, the I-Control variable being 8.338.

<table>
<thead>
<tr>
<th>Post Attrition Calculated Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>I-Control</td>
</tr>
<tr>
<td>Knowledge</td>
</tr>
<tr>
<td>Vulnerability</td>
</tr>
<tr>
<td>VHP</td>
</tr>
<tr>
<td>Intention</td>
</tr>
</tbody>
</table>

Composite variables were determined a priori using concepts stemming from theories developed in accordance with the panel of experts. An Inter-Item Correlation Matrix was carried out to confirm the a priori development of variables. Figure 8 shows which groups of questions from the survey compose each variable. The Correlation Matrix (Figure 9) indicates no strong correlations exist between variables, supporting the designation
of items to constitute each variable. It should be noted that at the second distribution of the survey an item was added to measure intended long-term adherence. The long-term adherence question, Item 31, was added to the intention variable, which stated, “I will continue to perform testicular self-examination because of this study.”

<table>
<thead>
<tr>
<th></th>
<th>IControl</th>
<th>Knowledge</th>
<th>Vulnerability</th>
<th>VHP</th>
<th>Intention</th>
</tr>
</thead>
<tbody>
<tr>
<td>IControl</td>
<td>1.000</td>
<td>-.063</td>
<td>.323</td>
<td>.315</td>
<td>.202</td>
</tr>
<tr>
<td>Knowledge</td>
<td>-.063</td>
<td>1.000</td>
<td>.260</td>
<td>.215</td>
<td>.300</td>
</tr>
<tr>
<td>Vulnerability</td>
<td>.323</td>
<td>.260</td>
<td>1.000</td>
<td>.053</td>
<td>.273</td>
</tr>
<tr>
<td>VHP</td>
<td>.315</td>
<td>.215</td>
<td>.053</td>
<td>1.000</td>
<td>.159</td>
</tr>
<tr>
<td>Intention</td>
<td>.202</td>
<td>.300</td>
<td>.273</td>
<td>.159</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Figure 9
## Composite Variables

### I-Control, Items 4-7

4. I am in control of my health  
5. I am in control of prolonging my life.  
6. I have control in performing healthy behaviors  
7. I can change/influence other people’s behavior

### Vulnerability, Items 8-11

8. I can contract a life threatening disease at this point in my life  
9. I can die prematurely  
10. I am at risk for testicular cancer  
11. I am vulnerable to getting testicular cancer at my age

### Knowledge, Items 1-2, 12-16, 22-23

1. I am informed about testicular cancer  
2. I am informed about testicular cancer self-examination  
12. I am among the highest risk group for getting testicular cancer  
13. Testicular cancer is a threat to my health and well-being  
14. Testicular cancer appears mostly in men who play sports  
15. Testicular cancer appears mostly in “weak” men  
16. Testicular cancer is an “old man’s disease”  
22. Testicular self-examination will reduce your risk of getting testicular cancer  
23. Testicular self-examination is easy to do

### Value of Health Promotion, Items 17-20, 21, 24-26

17. There are personal benefits to performing health behaviors  
18. There is value in health promotion  
19. Health promotion an important component of men’s health  
20. Testicular self-examination is a valuable tool to prevent testicular cancer  
21. Testicular self-examination can assist in prolonging your life.  
24. Testicular self-examination is a good cancer prevention tool  
25. Testicular self-examination is embarrassing  
26. Testicular self-examination is a responsible thing to do

### Intention, Items 27-30

27. I would discuss testicular self-examination with friends/family  
28. I will consider performing testicular self-examination sometime soon  
29. I will perform testicular self-examination this month and will plan to continue to perform it monthly  
30. I will not perform testicular self-examination

Figure 8
ADDITIONAL ANALYSES

T-tests

A paired samples t-test was conducted to compare means between pre- and post-test groups (n=22). This sample size includes all study groups, the only consistent study-related factor being the informational pamphlet. Figure 7 contains the means calculated and used in the paired samples test. T test analysis (Figure 10) indicates a significant difference (p<.05) in all variables except I-Control, which reported a significance value of .289.

<table>
<thead>
<tr>
<th>Paired Samples Test: Including All Groups</th>
<th>Paired Differences</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>Std. Deviation</td>
<td>Std. Error</td>
<td>Mean</td>
<td>95% Confidence Interval</td>
</tr>
<tr>
<td>Lower</td>
<td>Upper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1</td>
<td>IControl - IControlP</td>
<td>-0.23011</td>
<td>0.99204</td>
<td>0.21150</td>
</tr>
<tr>
<td>Pair 2</td>
<td>Knowledge - KnowledgeP</td>
<td>-1.53409</td>
<td>1.43590</td>
<td>0.30614</td>
</tr>
<tr>
<td>Pair 3</td>
<td>Vulnerability - VulnerabilityP</td>
<td>-1.20170</td>
<td>1.39193</td>
<td>0.29676</td>
</tr>
<tr>
<td>Pair 4</td>
<td>VHP - VHPP</td>
<td>-0.56676</td>
<td>0.87427</td>
<td>0.18640</td>
</tr>
<tr>
<td>Pair 5</td>
<td>Intention - IntentionP</td>
<td>-1.29886</td>
<td>1.14924</td>
<td>0.24502</td>
</tr>
</tbody>
</table>
An additional paired samples test was conducted on the post-attrition sample. This sample excluded control group 2, the true control group, because this was the only group that did not include the exposure to the seminar. Remaining study groups (n=17 overall) received both the baseline communication seminar and the educational pamphlet. Figure 11 demonstrates means (pre-and post-test) calculated for the participants receiving both interventions.

<table>
<thead>
<tr>
<th>Paired Samples Means: Excluding Control Group 2</th>
<th>Mean</th>
<th>N</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair IControl</td>
<td>7.9816</td>
<td>17</td>
<td>1.37868</td>
<td>.33438</td>
</tr>
<tr>
<td>1 IControlP</td>
<td>8.3787</td>
<td>17</td>
<td>.99203</td>
<td>.24060</td>
</tr>
<tr>
<td>Pair Knowledge</td>
<td>5.1029</td>
<td>17</td>
<td>.83633</td>
<td>.20284</td>
</tr>
<tr>
<td>2 KnowledgeP</td>
<td>6.6912</td>
<td>17</td>
<td>.63022</td>
<td>.15285</td>
</tr>
<tr>
<td>Pair Vulnerability</td>
<td>6.5257</td>
<td>17</td>
<td>1.77026</td>
<td>.42935</td>
</tr>
<tr>
<td>3 VulnerabilityP</td>
<td>7.7169</td>
<td>17</td>
<td>2.07125</td>
<td>.50235</td>
</tr>
<tr>
<td>Pair VHP</td>
<td>7.6783</td>
<td>17</td>
<td>.85744</td>
<td>.20796</td>
</tr>
<tr>
<td>4 VHPP</td>
<td>8.3456</td>
<td>17</td>
<td>.75652</td>
<td>.18348</td>
</tr>
<tr>
<td>Pair Intention</td>
<td>6.1618</td>
<td>17</td>
<td>1.07530</td>
<td>.26080</td>
</tr>
<tr>
<td>5 IntentionP</td>
<td>7.4588</td>
<td>17</td>
<td>.92690</td>
<td>.22481</td>
</tr>
</tbody>
</table>

T test analysis of above calculated means indicates significant differences in all variables except I-Control, as previously observed. It was noted that the significance value of the I-control variable decreased from the aforementioned value.
of .298 to .144, approaching the accepted value of p<.05 (see Figure 12).

Paired samples testing was also carried out on reported adherence to TSE recommendations. Values from the frequency reported on the screener survey were compared to values reported at the end of the study (see figure 13). The t-test indicates a significant relationship (p<.001) exists in TSE frequency post intervention (seminar, pamphlet, and text reminders) as noted in Figure 14.
Regression Analysis

A regression analysis was conducted with Intention to perform testicular self-examination serving as the dependent variable and the four remaining variables (I-Control, Knowledge, Vulnerability, and Value of Health Promotion) as the independent variables. One regression run was done on the total pre-test sample (n=75) and another on the post-test sample where attrition resulted in a sample size of 22. The adjusted variance explained value ($r^2$) for the pre-test group was .158 and the significance value was .016 (see Figure 15). For the post-test regression, $r^2$ was .232 and a significance value of .314 was reported (see Figure 16).
Beta weights of the four independent variables range from .051 to .306, as seen in Figure 17. Of the four variables, Knowledge was shown to be most predictive of the dependent variable, Intention with the highest weight (.306).

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>95.0% Confidence Interval for B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
</tr>
<tr>
<td>(Constant)</td>
<td>2.258</td>
<td>1.217</td>
<td>1.855</td>
</tr>
<tr>
<td>IControl</td>
<td>.145</td>
<td>.118</td>
<td>.154</td>
</tr>
<tr>
<td>Knowledge</td>
<td>.306</td>
<td>.141</td>
<td>.260</td>
</tr>
<tr>
<td>Vulnerability</td>
<td>.085</td>
<td>.068</td>
<td>.153</td>
</tr>
<tr>
<td>VHP</td>
<td>.051</td>
<td>.130</td>
<td>.047</td>
</tr>
</tbody>
</table>

Figure 17
Reliability and Validity

Content validity was assessed using a panel of experts in the Men’s Health field. Dr. Michael J. Rovito from University of Central Florida served as the primary expert with consultations from Dr. James E. Leone and Dr. Frank Johnson, both experts in the field of men’s health.

Cronbach’s alpha internal consistency calculation was utilized to assess reliability of the measurement tool. Pre- and post-test analysis results were reported as 0.672 and 0.626 respectively. Both calculations were based on the 30 survey items; the added item for the second distribution of the survey not included in the second computation.

Internal consistency measures were also taken for each variable individually. Figure 18 shows the results of these calculations with vulnerability obtaining the highest score.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cronbach’s Alpha</th>
<th>N items</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-Control</td>
<td>.667</td>
<td>4</td>
</tr>
<tr>
<td>Knowledge</td>
<td>.317</td>
<td>10</td>
</tr>
<tr>
<td>Vulnerability</td>
<td>.774</td>
<td>4</td>
</tr>
<tr>
<td>VHP</td>
<td>.559</td>
<td>8</td>
</tr>
<tr>
<td>Intention</td>
<td>.630</td>
<td>3</td>
</tr>
</tbody>
</table>

Figure 18
Attrition Analysis

A final analysis was carried out to compare means between those participants that dropped out of the study and those that did not. Groups were coded as 0 representing the participants that dropped out (n=53) and 1 representing the remaining participants (n=22). Figure 19 contains values for the calculated means for each composite variable of said groups.

<table>
<thead>
<tr>
<th>Composite Variables Means: Pre/Post Attrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>POST</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>IControl</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Vulnerability</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>VHP</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Intention</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Significance of variances of the reported means was calculated using Levene’s Test. Results of this test indicate no significant variance in the way participants responded. A t-test analysis was also done to compare group means. This also
indicated that a significant difference did not exist between those participants that dropped out of the study and those that did not. It can be stated that equal variance was observed between all participants, supported by the described tests (see Figure 20).

<table>
<thead>
<tr>
<th></th>
<th>Levene’s Test for Equality of Variances</th>
<th></th>
<th></th>
<th></th>
<th>Mean Difference</th>
<th>Std. Error Difference</th>
</tr>
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Figure 20
DISCUSSION

STUDY OVERVIEW

This study overall aimed to accomplish two goals: show the effectiveness of mobile phone technology to promote TSE and increase adherence, and to obtain reliability and validity measures for original instrumentation in the form of a 30-item questionnaire. The dependent variable was Intention to perform TSE and the independent variables were I-Control, Knowledge, Vulnerability, and Value of Health Promotion. Interventions included an educational seminar, an informational pamphlet, and the use of text reminders. As a result of this study, an educational seminar modeled by Witte’s (1992) theory, which includes high threat messages followed by high efficacy interventions, was developed and tested for effectiveness.

The independent and dependent variables were determined from the questionnaire and tested using a series of within group means tests and paired t-test. Cronbach’s alpha was used to test internal consistency using both the pre-test results and the post-test results obtained after attrition. In addition, the internal consistency measurement was broken down to indicate the strongest variables. Variance was ensured and analyzed using the homogeneity of variance test followed by an ANOVA. Finally, a regression analysis and paired samples testing was carried out.
to evaluate the predictability for and actual reported adherence to the Intention variable.

Resultant findings cannot confirm or strongly support the hypotheses due to the unfavorable sample size resulting from attrition. While correlations cannot be made, some positive trends were noted in support of Hypothesis 1 and overall adherence to performance of self-examination. These findings, along with some new observations, lend cause for further investigation of this ‘at risk’ demographic.

SYSTEMS ANALYSIS

The primary intent of this study was to develop a technologically advanced communication system to deliver monthly TSE reminders. Convenience for participants and privacy of messages were key in the development of said system. Text messaging was the outlet used for delivery of reminders and Witte’s (1992) theory was instrumental in the development of the messages delivered to participants.

Dissemination of text message reminders was carried out using e-mail to text through a Yahoo e-mail account created for the study. This method of message delivery was successful in maintaining organization. Groups were created to organize contacts according to study groups allowing for timely distribution of messages. While message confirmation was not
possible, ‘failure of delivery’ notices were received in which
the participant’s phone number was identified. If failure
notices were received a copy of the original message was sent
only to the participant(s) mentioned. A confirmation of message
receipt would have been beneficial in tracking which
participants dropped out due to lack of interest, as it could
not be known for sure that participants were receiving the
communication.

Kim Witte’s (1992) high threat/high efficacy theory was
employed in message delivery at baseline communication, the
educational seminar. Men were educated on the risk and severity
of testicular cancer (high threat). For example, it was
emphasized that testicular cancer is a leading cause of death in
15-54 year old men, it is one of the fastest growing cancers,
and it spreads to other organs much quicker than most other
cancers. After high threat was established, an effective
solution was presented (high efficacy). By performing self-
examination monthly, abnormalities are noted in a timely manner
and attention is given to the matter in the form of further
evaluation by a physician. This may lead to early detection of a
tumor, which can be treated. It was emphasized that early
detection is key in making this cancer curable. The seminar
concluded with proper technique and resources for participants to refer to, all part of the high efficacy component.

Message design was also based on Witte’s (1992) model, although, the high efficacy element was emphasized. Using the e-mail to text feature limited messages to 160 characters therefore; emphasis was given to reminding participants using the high efficacy solutions presented at the seminar. Participants were encouraged to address any concern that may come of the examination by referring to the resources given.

Proper means testing was impossible to carry out due to the high attrition rate leading to the final sample size of 22 men. Although, paired samples means testing was conducted and indicated significance in all variables except the I-Control variable (refer to Figures 10 and 12). The first test was run on all groups, which shared in common the informational pamphlet*See Appendix E for copy*, while the second test assessed only the groups receiving the baseline communication. Significant scores indicate effectiveness of the intervention; although it cannot be stated specifically which intervention was most successful, nor can we isolate what specifically was successful about the intervention. A larger sample size would allow for proper between group analyses that would pinpoint the intervention responsible for the variance.
Another component of the communication system was the use of e-mail to deliver any surveys after the initial primary survey given at baseline communication. Qualtrics was the online program used to create the surveys and disperse them to participants. Advantages to using this program include convenience for participants and accurate record keeping for the investigator. The software was simple and included many features beneficial for data collection. Also, participant identity was effectively kept confidential with no identifying information provided aside from an IP address. A question was added to track participants, they were asked to provide the study ID determined at initiation into the study.

A major limitation to both components of this system is the loss to follow up. Participants could become careless and simply ignore any communication pertaining to the study. It is possible that this partly accounts for the observed attrition rate of 71%. Another observation in the attrition rate is related to ages. It was noted that 30 of the original 35 participants in the 18-19 age group dropped out of the study, seen in the age distribution graphs (Figures 2 and 3). This is an attrition rate of 85% for that age group which accounts for 57% of the overall attrition. This supports previous findings from Bell, Powers, and Young (2006). In their study, Bell, Powers, and Young
investigated causes of attrition in a longitudinal study using a cohort of women of ages ranging from 18–75. The younger age group (18–23) had the highest attrition rate of the three groups identified. Social factors, such as lack of knowledge of importance of research, were the main cause of attrition in this group. It is possible for the cohort in this study to have similar reasons for dropping out.

Overall the system has the potential to be effective. Results of this study indicate some positive trends that should be retested and further evaluated. Figures 10–14 illustrate the significance observed from the pre- and post-test analysis of the composite variables indicating a significant difference in the variables, except IControl, due to the interventions implemented by this study. Most importantly, Figures 13 and 14 indicate a strong significant relationship (p<.001) in the reported adherence to TSE due to the study. It was also interesting to note that attrition of experimental group 1 (receiving 1 text reminder a month) was 74%, while the rate for experimental group 2 (receiving 2 text reminders a month) was 59%. This could indicate that a more constant reminder sustained the interest of the participants. A study done using a larger sample size (achievable through oversampling) is warranted and
is strongly believed to result in stronger relationships and more conclusive evidence.

INSTRUMENTATION ANALYSIS: RELIABILITY AND VALIDITY

An equally important goal of this study was to obtain high reliability and validity scores for the original instrumentation. Through validation, said instrumentation becomes an utilisable means of measuring the effectiveness of the private reminder system. This pilot study was aiming to obtain a reliability assessment of .85 or greater on all surveys/scales in order to establish consistency and ensure measurement continuity.

The key variables used to test the study’s hypotheses were assessed for internal and content validity. Dr. Michael J. Rovito of the University of Central Florida, Dr. James E. Leone of Bridgewater State University, and Dr. Frank Johnson of Temple University served as the panel of experts used to institute a content validity check of the primary survey. An Inter-Item Correlation Matrix (see Figure 9) served to further assess the key variables. Because no significant correlations existed between the variables it can be concluded that they were independently measuring the intended component.

Two Homogeneity of Variances tests were conducted (Figures 5 and 20) to ensure that the assumption of equal variance was
valid. The tests were done on the pre- and post-attrition samples, both indicating no significance and therefore validating the assumption. The ANOVA test (Figure 6) further supported the equal variances assumption, as no significance was noted between the groups. As a result, normal distribution of the all variables was assumed.

Reliability measures were conducted using Cronbach’s alpha measure of internal consistency. The pre- and post-attrition values were reported as .672 and .626 respectively with vulnerability accounting for the variable with the highest consistency and knowledge the variable with the lowest. While this does not fulfill the previously determined acceptable value of .85, it can be stated with confidence that a larger sample size would increase the value to meet the set criteria. This is concluded based on the difference noted in the reported Cronbach’s alpha scores, the larger score was based on the n=75 sample size before attrition.

Regression analysis done on the pre-test group of n=75 resulted in an $r^2$ value of .158, indicating a 16% predictive value of the independent variables for intention. The regression analysis run on the post-test group of n=22 indicated an $r^2$ value of .232; therefore, there was a 23% accountability of the questionnaire for predicting intention. Both internal
consistency measures indicate that intention was predictive. Beta weights indicate the Knowledge variable as being the most predictive although all the variables carried very low beta weights. Had there been a larger sample size, this predictive value would have been much higher.

DISCUSSION OF HYPOTHESES AND OUTCOMES

Attrition rates limited proper means testing of the hypothesis, between group comparisons were not possible with a sample size of 22. Nonetheless, overall TSE adherence was measured and analyzed using a paired samples means test. The pre-test average for reported TSE adherence was .73 while the post-test average was 3.77; Figure 14 illustrates this is a significant difference as p< .001. The question asked about TSE adherence over a range of months (3); therefore it can be stated that men increased adherence from less than once a month, before the study, to at least once a month at the end of the study.

While testing could not be carried out for Hypothesis 2, the attrition rates of the groups compared in this hypothesis are noteworthy. Experimental group 1, which received one reminder a month, experienced an attrition rate of 74% compared to an attrition rate of 50% in experimental group 2, receiving 2 text messages a month. Due to small group sizes, comparison of actual TSE adherence could not be measured, although it could be
stated that an increase interest in remaining in the study would indicate increased intentions to perform TSE as well.

This study suggests further investigation is necessary in the field relating to mobile phone outlets as the message delivery interface. It would be necessary to continue investigation on this topic to assess whether higher attrition rates are attributed to the communication system.

As a result of this study, an effective tool was created to measure behavior intention in relation to TSE. Positive trends indicate the tool is likely to have good reliability and internal consistency, while a panel of experts attributed to the determination of content validity. This tool could be further implemented in studies assessing a social media communication system to deliver monthly TSE informational reminders.

A possible finding of this study is that convenience is not advantageous in this age cohort. Also, it is possible that texting reminders may have been too personal for participants. This lends credence to use of social media outlets to distribute reminders. It is possible that by including a social network men are more apt to remain connected and take an active role in their health.
LIMITATIONS

Convenience sampling limits the generalizability of the study findings while self reported survey data introduces possible participant bias. Additional convenience of sampling was introduced in control group 2, as these were personally known individuals, which then snowballed using word of mouth. This may also introduce a knowledge bias because a large portion of this group is likely to be health related majors.

The use of original instrumentation introduces limitations in the reliability and validity of the survey and a potential source of error to the study. For this reason it was necessary to carry out this pilot study and test said instruments. Readability will not be an issue as all participants are college students and are assumed to have the ability to read at a college level. However, a knowledge bias may result due to the overly educated population being used in the experiment.

Additional limitations in the instrumentation arise from the conversion of the 5-point scale to a 10-point scale. The 5-point Likert type scale was used for the convenience of participants, while for data analysis purposes a 10-point scale is more useful. Dawes’ (2008) scale conversion was used for this study. In his own study, Dawes demonstrates that very little difference exists in the means calculated from conversions,
which validates the use of a simple transformation. The scale conversion used for this study is as follows: 1=1, 2=3.25, 3=5.5, 4=7.75, and 5=10. For future studies, it is recommended to use a 10-point scale to avoid this.

The age range of study participants was initially heavily skewed toward the younger population. Possible sources of this arise from recruitment methods. Classroom solicitation occurred in large amphitheater, General Education classes, which likely contained many first year students. In addition, recruitment at campus fraternity houses occurred during new pledge recruitment. This could pose as another source of young participants. Lack of commitment and interest from the younger participants is a possible source of attrition in this study with 83% of the 18-19 year old age group dropping out.

During recruitment, sign-in sheets were passed around large classrooms and the fraternity houses to expedite the process of gather possible participant data. This became a major concern as illegible handwriting was commonly encountered. The same problem arose from the sheets used to recruit in front of the Student Union.

Were there to be a highly publicized TSE screening campaign (such as Lance Armstrong’s high-profile case), rates of participation and intent to be screened might be higher than
expected for all participants, at least in the short term. Because participants were randomized when placed in a message group, media effects should affect all subjects equally. Because this pilot study establishes feasibility for a fully powered trial, the effect sizes produced would not reflect what would be achieved in the larger study in the event or absence of a media event.

Attrition proved to be the principal limitation in this study, as rates were well above those expected. This created a major gap in statistical analysis as only within group analyses were performed and no between group analyses were included. It is reiterated with confidence that a larger sample size would have provided more concrete evidence to support all hypotheses.

RECOMMENDATIONS FOR FUTURE RESEARCH

Using the key variables in this study, future studies should further analyze the Intention variable in relation to the Theory of Planned Behavior. The I-Control variable would function as the control belief, Value of Health Promotion serves as the behavioral belief and using Item 27 of the questionnaire with additional questions to measure the normative beliefs. These three beliefs are predictive of intention to perform the behavior. By understanding attitudes behind the intention to
perform a behavior, interventions specific to those attitudes can be implemented to increase intention.

Using the high self-efficacy modeled in this study in conjunction with interventions to change attitudes using the Theory of Planned Behavior, a more effective cue to action can be created to prompt a health behavior change. While this study indicates a promising way to increase intention to perform the behavior, a stronger cue to action might be necessary to elicit the change. In future studies it is recommended that the reminder (cue to action) include the threat and efficacy components of the EPPM as opposed to focusing on the efficacy as was done in this study.

A need still exists for studies measuring long-term adherence. This study measured long-term adherence in the form of a question added to the final survey (Item 31). The calculated mean for this item was 9.284, indicating a high intent to continue the behavior. Without further follow up one cannot know whether the intent was carried out and the behavior continued. This creates a need to replicate this study in order to determine if this communication system could indeed change the behavior of college men.

As previously stated, attrition posed the prevalent limitation for this study and indicates that a need still exists
to explore this topic. In future studies, investigators should oversample to triple amounts and expect an attrition rate of 50%, at minimum. For this study twice as many participants were recruited than needed and an attrition rate of 20% was expected.

By perfecting this one-on-one communication system, a gateway to using social communication becomes possible. Using men from whom behavior was altered because of the developed communication system as social media advocates, a public communication system can be developed. Opening the door to the world of social media provides limitless opportunities to influence individuals’ behaviors on a very large scale. This study is a foundation for a much needed communication network in the field of men’s health.
REFERENCES


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45. Witte, K. 1993. message and conceptual confounds in fear appeals: The role of threat, fear, and efficacy. Southern Communication Journal. 58, 147-155


APPENDIX A: IRB APPROVAL FORM
Approval of Human Research

From: UCF Institutional Review Board #1
FWA00000351, IRB00001138

To: Michael J. Rovito and Co-PI: Lisa M. Soler

Date: August 28, 2012

Dear Researcher:

On 8/28/2012, the IRB approved the following minor modifications to human participant research until 08/26/2013 inclusive:

Type of Review: IRB Addendum and Modification Request Form
Modification Type: Change to data dissemination: instead of original plan of using a cell phone as the central device, a free messenger system through Yahoo! mail will be used. In addition a revised flyer and TV ad have been uploaded for use in recruiting participants.
Project Title: The Effect of Text Messaging Alerts Upon Testicular Self-Examination (TSE) Adherence
Investigator: Michael J. Rovito
IRB Number: SBE-12-08596
Funding Agency: N/A
Grant Title: N/A
Research ID: N/A

The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form cannot be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu.

If continuing review approval is not granted before the expiration date of 08/26/2013, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in IRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

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

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

Signature applied by Joanne Muratori on 08/28/2012 04:41:53 PM EDT
APPENDIX B: SCREENER SURVEY
Last 4 digits of your phone number: __________

1. Have you ever been diagnosed with testicular cancer?
   a. Yes
   b. No

2. Over the past 6 months how many times have you performed testicular self examination?

   ______________________

3. Do you believe you are knowledgeable about testicular health and self-examination?
   a. Yes
   b. No

4. Do you have a reliable mobile device that can receive a maximum of 8 text messages throughout the next four months?
   a. Yes
   b. No

5. What is your mobile phone provider (e.g. Verizon, Sprint, etc)?

   ______________________
# Testicular Self-Examination Survey

**Age:**

**Study ID number (last 4 digits of your phone number):**

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<th>Neutral</th>
<th>Agree</th>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

For each item listed below, circle the number to the right that best fits your judgment of its quality. Use the scale to select the quality number.

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<th>Item</th>
<th>Scale</th>
<th>Item</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I am informed about testicular cancer</td>
<td>1 2 3 4 5</td>
<td>2. I am informed about testicular self-examination</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>3. I have performed testicular self-examination</td>
<td>1 2 3 4 5</td>
<td>4. I am in control of my health</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>5. I have control in prolonging my life</td>
<td>1 2 3 4 5</td>
<td>6. I have control in performing healthy behaviors</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>7. I can change/influence other people’s behavior</td>
<td>1 2 3 4 5</td>
<td>8. I can contract a life-threatening disease at this point in my life</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>9. I can die prematurely</td>
<td>1 2 3 4 5</td>
<td>10. I am at risk for testicular cancer</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>11. I am vulnerable to getting testicular cancer at my age</td>
<td>1 2 3 4 5</td>
<td>12. I am among the highest risk group for getting testicular cancer</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
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<td></td>
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<tr>
<td>---</td>
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<td>---</td>
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</tr>
<tr>
<td>13. Testicular cancer is a threat to my health and well-being</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>14. Testicular cancer appears mostly in men who play sports</td>
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<td>2</td>
<td>3</td>
</tr>
<tr>
<td>15. Testicular cancer appears mostly in “weak” men</td>
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<td>3</td>
</tr>
<tr>
<td>16. Testicular cancer is an “old man's disease”</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>17. There are personal benefits to performing health behaviors</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>18. There is value in health promotion</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>19. Health promotion is an important component of men’s health</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>20. Testicular self-examination is a valuable tool to prevent testicular cancer</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>21. Testicular self-examination can assist in prolonging your life</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>22. Testicular self-examination will reduce your risk of getting testicular cancer</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>23. Testicular self-examination is easy to do</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>24. Testicular self-examination is a good cancer prevention tool</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>25. Testicular self-examination is embarrassing</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>26. Testicular self-examination is a responsible thing to do</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>27. I would discuss testicular self-examination with friends and/or family</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>28. I will consider performing testicular self-examination sometime soon</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>29. I will perform testicular self-examination this month and will plan to continue to perform it monthly</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>30. I will not perform testicular self-examination</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
APPENDIX D: SECONDARY SURVEY
Secondary Survey

1. How many text messages are you receiving a month?

2. Are the text messages easy to understand?
   a. Yes
   b. No

3. How many times have you performed the recommended testicular self-examination since the seminar?

___________________________
What are Testicles?
Testicles are male reproductive organs that produce and store sperm. They also produce testosterone, a hormone that causes male traits such as facial hair and lower voice pitch.

Who is at risk for Testicular Cancer (TC)?
Testicular Cancer is the most common type of cancer in men ages 18 – 35. However since it accounts for only 1% of all cancers in men, many people are unaware of this type of cancer.

Risk Factors for TC
- Undescended testicles
- Abnormal testicular development
- Family history of testicular cancer
- Caucasian men are 5x more likely to develop TC than black men
- History of TC – Men who have had TC are at increased risk for developing cancer in the other testicle.

Symptoms of Testicular Cancer
Most common symptoms of TC are:
- small painless lump in a testicle
- a slightly enlarged testicle
- a sense of heaviness in the groin

It is important to be familiar with the size and feeling of your normal testicles, so you can detect any changes.

Other symptoms include:
- dull ache in the lower stomach/groin
- sudden accumulation of blood/ fluid in the scrotum

These symptoms can be a sign of an infection or other serious condition that may not be cancer. A doctor can tell if you have cancer and what the proper treatment should be.

Is Testicular Cancer curable?
In the past, testicular cancer was often fatal because it spreads so quickly to vital organs such as the lungs. Testicular tumors can double in size in just 10-30 days!

How do I perform a Testicular Self-Exam (TSE)?
Men should perform a TSE once a month.
- After a warm shower/bath to help the scrotal skin relax, making it easier to find anything unusual.
- Examine each testicle with both hands. The index and middle finger should be placed underneath the testicle, while the thumbs are placed on top (diagram below).

- Gently roll the testicle between the thumbs and fingers. Be aware, one testicle may be larger or hang lower than the other and this may be normal.
- The epididymis stores and transports sperm. It is located on the back of the testicles. Don’t confuse it for an abnormal lump!
- Feel for any hard, pea size lumps. Lumps can be sore but are usually painless.

To receive more info about TSE or men’s health contact:
MHInitiative@gmail.com

www.menshealthinfo.org

How to perform a Testicular Self Exam

Presented by the Men’s Health Initiative

Thanks to ICT for their continued support and collaboration efforts
APPENDIX F: ADVERTISEMENT FOR STUDY
The Men’s Health Initiative is looking for volunteer MALES to participate in a study concerning testicular self-examination.

WE ARE LOOKING FOR:
Males between the ages of 18-35 who have NEVER been diagnosed or treated for testicular cancer

Sound like you?
Contact Dr. Michael J Rovito for more information.
407-823-3888 MHInitiative@gmail.com

Let us know which short seminar you can attend on Friday, September 7th at 10 am, 1pm, or 3pm in HPA1 room 111. We’ll have free PIZZA!!!!

Study participants have a chance to win $100 in Knights Cash!

* To win the $100 Knights Cash, study participants can be entered in a drawing upon full completion of, and participation in, the study. The Men’s Health Initiative, based at UCF, directly conducts the drawing and is funding the prize. No purchase is necessary to be entered. The winning participant will collect his prize from operation headquarters after the 30th of November, at a time set up with Dr. Rovito.