EXAMINING THE UNDER-DIAGNOSIS OF OBSTRUCTIVE SLEEP APNEA THROUGH RIMAL’S RISK PERCEPTION ATTITUDE FRAMEWORK

By

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ABSTRACT

The primary aim of this study was to determine whether message tailoring through a web-based campaign could increase participants’ intentions to visit a physician about OSA. The secondary aims of the analyses were to identify important relationships related to message tailoring including risk perception, efficacy perception, perceived barriers, and demographic variables. Participants in this study were visitors to Sleep Solutions’ website (www.apnea.com) who opted to fill out an OSA risk survey (n = 138). Although the intervention did not significantly increase intentions to visit a physician for participants in the test condition, there are other important implications of this research for message tailoring as it relates to OSA. The research indicated that gender and race had a significant effect on intention to visit a physician. Additionally, the results of this study suggest that targeting perceived susceptibility and increasing awareness of the health risks associated with OSA may be important for future campaigns involving this condition.
INTRODUCTION

More than half of American adults have trouble sleeping a few nights per week or more according to surveys conducted by the National Sleep Foundation (1999-2004). Whether from stress, distractions, or busy schedules, the majority of American adults do not get the recommended 7-9 hours of sleep for optimal health. For some people, lack of sleep is an occasional or temporary problem that can be remedied through lifestyle changes if necessary. For others, such as the estimated 40 million adults suffering from sleep disorders, waking up feeling tired can be a frequent and persistent problem seemingly without a solution (National Sleep Foundation, 1999-2004).

Frequent feelings of tiredness due to inadequate sleep may be indicative of a serious and deadly sleep disorder known as obstructive sleep apnea. Obstructive sleep apnea (OSA) is a type of sleep disordered breathing in which a person’s airway becomes blocked during sleep. This blockage results in periodic episodes during which the person ceases to breathe (Davidson, Do & Justus, 1999). Cessations in breathing brought on by OSA can last anywhere from ten seconds to several minutes (Lung Disorders, 2003). To be considered as OSA, a person must have five or more obstructive breathing episodes per hour (Olbrich, Muhlhans, Allison, Hahn, Schahin, & Zwaan, 2009).

Although it may be viewed as merely a “snoring” issue, an increasing number of studies have demonstrated the serious outcomes of untreated OSA. Untreated sleep apnea has been linked to many external and internal consequences including mood disorders, impaired driving, and an increased risk of cardiovascular problems (Cherniak, 2005; Rodenstein, 2009; Gurubhagavatula, Nkwo, Maislin, Pack, 2007;
Even though OSA can cause serious health consequences, the condition is vastly under-diagnosed. Consequently, many who have the condition remain untreated. Researchers estimate that as many as 75-80% of OSA cases in the United States are left untreated (Young, Skatrud, & Peppard, 2004).

Several barriers could explain why those with the condition are not seeking diagnosis. The cost and inconvenience of traditional diagnosis may pose a significant barrier for individuals. The typical diagnosis for OSA requires a person to stay in a sleep lab for up to three nights. This can be expensive as the cost of an in-lab diagnosis can total over $1500 per patient (Rice et. al, 2006). The test can also be inconvenient for the patient as the three night requirement may interfere with work schedules and family obligations in addition to the inconvenience posed by being monitored by strangers while sleeping in an unfamiliar environment. Another inconvenience patients might face in undergoing lab testing is being placed on a waiting list of six months or more (Rice et. al, 2006). Patients living in less-populated areas may even have to travel to other cities to find a lab offering OSA testing (Reichert et. al, 2003).

Recently, home diagnostics have been developed to make OSA diagnosis more convenient and less expensive. Home diagnostics for OSA allow patients the convenience of testing for OSA within their own homes without the higher costs associated with in-lab testing. On average, the cost of a home diagnostic for OSA is 35-88% lower than in-lab testing before insurance co-pays (Ghegen, Angelos, and Stonebraker, 2006). In order to obtain a home diagnostic, a patient must first obtain a
prescription from a physician. The patient will then complete a three night sleep study in
which he or she will wear sensors during sleep to record information about heart rate, respiration, and the presence and intensity of snoring (Reichert et. al, 2003).

Despite the availability of a cheaper and more convenient method for diagnosing OSA, the problem of under-diagnosis persists. This may be partly due to the fact that OSA has typically been seen as a minor inconvenience characterized by snoring rather than as a potentially life-threatening condition. If risk perception were increased in those who may have undiagnosed OSA, those at risk may be more motivated to visit a physician about the condition.

Current messages about the availability of home diagnostics for OSA may be failing to properly motivate those at risk for OSA to seek diagnosis. Health communication theory can provide useful insight into the reasons those at risk for the condition do not seek diagnosis and may also help identify mechanisms for motivating the undiagnosed to see a physician. This review seeks to explain the pervasive and severe problem of OSA and patient barriers to seeking diagnosis with the aim of determining what types of messages are best for influencing those at risk to visit a physician about receiving an OSA diagnostic.
Prevalence and Risk Factors of OSA

Obstructive sleep apnea is a common sleep disorder among American adults. Researchers have estimated that roughly one in every five adults has a mild form of OSA and one in every fifteen adults has a moderate or more severe type of OSA (Young, Skatrud, & Peppard, 2004). Prevalence increases for middle-aged adults. Researchers estimate that nearly 24% of middle-aged men and 9% of middle-aged women have some form of OSA (Young et. al, 1993).

Even though OSA is a widespread problem, there are factors that can be used to determine one’s risk of having the condition. These factors include obesity, smoking, and older age (Young, Skatrud, and Peppard, 2004). Additionally, men are between two and three times more likely to have OSA than are women (Olbrich, Muhlhans, Allison, Hahn, Schahin, & Zwaan, 2009).

Some of the risk factors for OSA can be modified through lifestyle. This is the case for obesity which has been found to be both a strong risk factor for OSA development and a determinant in OSA severity (deSousa et. al, 2008; Lopez, Stephan, Schulman, and Byers, 2008; Peppard, Young, Palta, Dempsey, and Skatrud; Young, Skatrud, and Peppard, 2004). The prevalence of OSA in obese persons is estimated to be 40%; in the morbidly obese, the prevalence rises to 70% (Lopez, Stephan, Schulman, and Byers, 2008). Researchers in the Wisconsin Sleep Cohort Study, a study tracking 948 participants over four years, discovered that when subjects increased their weight by 10%, they had six times the chances of developing moderate to severe sleep disordered breathing. Additionally, with a 10% increase in weight, participants had a 32% increase
in the number of apnea events experienced during sleep (Peppard, Young, Palta, 
Dempsey, and Skatrud, 2000).

Obesity rates in the U.S. are continuing to rise. According to research conducted 
by the CDC in 2005-2006, 67% of American adults over the age of 20 are overweight; 
34% of American adults over the age of 20 can be classified as obese. As obesity reaches 
epidemic proportions, so too may the problems posed by OSA.

Cigarette smoking, another lifestyle risk factor, has also been found to contribute 
to the development of OSA (Wetter, Young, Bidwell, Badr, and Palta, 1994; Lavie, 
2008). The Wisconsin Sleep Cohort Study examined the occurrence of apneas in subjects 
who were identified as nonsmokers, former smokers, or current smokers. They found that 
current smokers had three times the risk of developing OSA than nonsmokers or former 
smokers. Researchers also discovered that heavy smokers were at an even greater risk 
than were light or moderate smokers (Wetter, Young, Bidwell, Badr, and Palta, 1994). 
Smoking has also been found to have an interaction effect with OSA to increase the risk 
of cardiovascular disease (Lavie, 2008).

In addition to risk factors brought on by lifestyle choices, some of the risk factors 
for OSA are based on demographics and are thus incapable of modification to decrease 
risk. Age is one such risk factor (Larrson, Lindberg, Franklin, and Lundback, 2003; 
Young et. al, 1993). A study by Larrson, Lindberg, Franklin, and Lundback, looked at 
5,424 subjects between the ages of 20 and 60 to determine during which ages apneas 
most frequently occur. The researchers found that in men, snoring and witnessed sleep 
apneas occurred most frequently in those between the ages of 55-59. In women, the age
in which snoring and witnessed sleep apneas occurred most frequently was 60-64 (Larrson, Lindberg, Franklin, and Lundback, 2003).

Another demographically-based risk factor for OSA is biological sex (Olbrich, Muhlhans, Allison, Hahn, Schahin, & Zwaan, 2009; Young, Finn, Austin, and Peterson, 2003). Researchers examined the link between females and OSA development to determine that hormones may be responsible for why men are more likely to have OSA than are women. Researchers looked at 589 women at varying stages of menopause (premenopausal, perimenopausal, and postmenopausal) to determine the presence of apneas through polysomnography. Researchers found that postmenopausal women were three times more likely to have moderate-to-severe OSA than were premenopausal women, suggesting that shifting hormone levels after childbearing years may increase risk in women. This effect was found even when confounding variables such as age and weight were eliminated (Young, Finn, Austin, and Peterson, 2003).

Some of the risk factors for OSA, such as obesity and smoking, are modifiable through lifestyle changes. Other risk factors for the condition are incapable of modification. This includes demographic risk factors, such as age and sex, as well as genetic predisposition. Although the link between genetics and OSA has not been completely determined, researchers suggest that genetics may contribute in several ways (deSousa et. al, 2008; Patel et. al, 2008; Redline and Tishler, 2000). One important consideration is that genetics may be in part responsible for the development of obesity through lifestyle factors and genetic predisposition (deSousa et. al, 2008; Patel et. al, 2008; Redline and Tishler, 2000). Researchers predict that “genetic factors associated with craniofacial structure, body fat distribution, and neural control of the upper airway
muscles” can interact to increase one’s risk for the condition (Redline and Tishler, 2000, p. 583).

Many risk factors for OSA have been identified. We now know the lifestyle factors, demographic information, and genetic influences that play a role in the development of the condition. Most of the risk factors, with the exception of genetics, provide useful information to assist researchers in targeting those at risk for OSA. However, to date, efforts to ameliorate the problem of under-diagnosis of OSA have been largely futile. One explanation for why previous efforts have not been widely successful may be due to inaccurate perceptions regarding not only the susceptibility of individuals to OSA but also the severity of the condition.

Severity of OSA

The presence of untreated OSA has been linked with serious physical consequences. An observational cohort study conducted by the Yale University Center for Sleep Medicine looked at the relationship between OSA and the prevalence of strokes by having 1022 subjects undergo polysomnography to determine the presence of OSA. Researchers then tracked the occurrence of strokes and deaths in those with diagnosed OSA compared to those with normal polysomnography results. Results from the study indicated that OSA is associated with an increased chance of suffering from stroke or early death from any cause, even after eliminating cardiovascular and cerebrovascular risk factors (Yaggi, Concato, Kernan, Lictman, Brass & Mohsenin, 2005).

A similar observational cohort study conducted by Johns Hopkins University examined the link between OSA and early death. The study looked at 6441 men and women between the ages of 40-70 who were not being treated for OSA. Roughly half of
the research participants had moderate to severe forms of the condition. Over eight years researchers tracked participants’ deaths. Based on the data collected, researchers estimated that the presence of untreated OSA can increase the chances of dying an early death by nearly 40% particularly in men between the ages of 40-70 (Punjabi et. al, 2009).

In addition to causing serious physical consequences, untreated obstructive sleep apnea has also been linked to sleep and mood disorders (Bardwell et. al, 2003, Cherniak, 2005). Untreated OSA has been associated with the presence of insomnia, causing many with the condition to awake tired and to feel sleep-deprived throughout the day (Bardwell et. al, 2003). Insomnia in individuals with untreated OSA can lead to an increased risk of mood disorders, such as anxiety, depression, and suicidal thoughts (Cherniak, 2005). Daytime tiredness from insomnia has been found to result in fatigue and decreased physical work capacity in those with untreated OSA (Aguillard et. al, 1998). Additionally, due to daytime tiredness, those with untreated OSA have three times the risk of being involved in a traffic accident as does the general population (Rodenstein, 2009).

Although research has demonstrated the severe physical and psychological consequences of untreated obstructive sleep apnea, many with the condition are not seeking treatment. This could be explained, in part, by individuals’ perceived barriers in seeking diagnosis of the condition.

**Barriers to Diagnosis**

In the past, diagnosing a patient with OSA involved an extensive evaluation within a sleep lab. After meeting with a doctor to discuss suspected OSA, a patient traditionally would undergo a sleep study in a sleep lab to confirm the presence of OSA.
The sleep lab conducts an in-lab polysomnography (PSG) to diagnose the condition. Polysomnography detects and records respiratory disruptions during sleep to detect the presence of OSA, its severity if present, and whether any other sleep disorders are occurring. Typically the PSG is conducted at night, sometimes over a period of three days, to more accurately analyze nighttime breathing (Armon, 2007).

However, this diagnostic process can present numerous burdens for the patient (Reichert et al, 2003; Rice et. al, 2006). The in-lab diagnosis of OSA can be unfavorable for the patient due to “the high cost of this technician-dependent procedure, patient acceptance of in-lab testing, potential for lengthy waiting periods, limited access in geographically remote locations, significant inter-coder variability, night-to-night variability in the apnea” and other complications (Reichert et. al, 2003 p. 213). An additional problem is posed by the fact that there are not currently enough labs to accommodate the vast number of persons with undiagnosed OSA if they were to seek evaluation (Reichert et. al, 2003).

In response to the unfavorable attitudes toward the traditional OSA diagnostic process, companies have recently developed home diagnostics for OSA. These home tests have reduced the barriers of cost and inconvenience by allowing patients to take a sleep study in the comfort of their own home for roughly one-third of the cost of attending a three night sleep study in a sleep lab (Rice et. al, 2006). In order to receive the diagnostic, a patient must visit his or her doctor to request a prescription for a home sleep study (Rice et. al, 2006).

Home diagnostic tests have been successful in diagnosing OSA in addition to being more cost-efficient and convenient for patients. There have been few reported user
errors in OSA at-home diagnostics. In one research study, 99 out of 100 patients successfully performed an at-home OSA self-diagnostic test and the one patient who did not perform the test successfully the first time was able to effectively complete the task on the second attempt (Davidson, Do, & Justus, 1999). Additionally, the results obtained from at-home diagnostics of OSA are comparable in accuracy to in-lab testing. In a study of Sleep Solutions’ NovaSom at-home test of OSA, results from the home diagnostic were reliable at over 95% when compared to traditional in-lab testing (Reichert et al, 2003).

Once diagnosed with the condition, proper treatment for OSA has been shown to decrease chances of early death and OSA-related health risks (Tipton and Hall, 2001). Treatment typically involves the use of a device system called continuous positive airway pressure (CPAP). This method of treatment requires users to wear a nasal mask attached to an air pump that assists in keeping airways open during sleep (Lung Disorders, 2003). Research has shown that in men with OSA, those who were successfully treated for their condition were 66% less likely to suffer from future cardiovascular problems (Harvard Heart Letter, 2005). Effective treatment of OSA through the use of a CPAP can help patients to have “decreased daytime sleepiness, improvements in subjective sleep quality in patient and sleep partner; improved psychologic well-being; cognitive function; and quality of life; decreased numbers of traffic accidents; and small decreases in blood pressure” (Tipton & Hall, 2001 p. 1024).

Even with the availability of a more affordable and convenient way to diagnosis OSA, 75-80% of OSA cases in the United States remain untreated (Young, Skatrud, & Peppard, 2004). With the increased rates of morbidity associated with untreated OSA,
the disparity between those with the condition and those being treated for the condition is a major cause of concern. Even though there is a clear problem, the severity and pervasiveness of OSA, and a seemingly easy solution, to see a physician to obtain a prescription for a home diagnostic of OSA, those at risk are still failing to seek help. These individuals may not be sufficiently motivated to seek diagnosis due to inaccurate perceptions of risk associated with OSA.

Health Communication Campaigns

Health communication campaigns involve “the production and exchange of information to inform, influence or motivate individual, institutional, and public audiences about health issues” (Maibach, 2007, p. 88). Health communication campaigns have been successfully used to target a variety of health behaviors such as seat belt use, tobacco use, alcohol consumption, medication use, disease prevention, and physical activity and exercise (Snyder, 2007).

Meta-analyses of health communication campaigns conducted by Snyder and Hamilton (2002) and Derzon and Lipsey (2002) have demonstrated empirical support for the ability of health communication campaigns to positively influence behavior change. In garnering empirical support for the effectiveness of health communication campaigns, meta-analyses have revealed important characteristics of successful health communication campaigns. Snyder and Hamilton (2002) found that campaigns were most effective when they focused on adopting new behaviors rather than ending problematic behaviors. Additionally, selection and implementation of theory, or model of health behavior change, has been found to play a critical role in health communication campaign success (Noar, 2006).
Critics of health communication campaigns may argue that due to the small effect size of health communication campaigns, such efforts may be of little value. However, although the average campaign is responsible for positive behavior change in 8% of the population, this statistic can be misleading without looking at the broader context (Snyder and Hamilton, 2002). When a campaign can reach a large population, it has the potential to cause significant positive change. Snyder and Hamilton explain this in stating that “it is crucial to remember that small percentage changes may affect very large numbers of people in a community, state, or national campaign. An 8% change in a city of 100,000 targeted adults would yield 8000 more people engaging in the desired health behavior” (Snyder and Hamilton, 2002, p. 89). Although seemingly modest, the effects of a far-reaching health communication campaign could significantly impact the vast numbers of individuals with undiagnosed OSA.

Models of Health Behavior Change: Perceptions of Risk and Efficacy

An important step in beginning a campaign is to select and implement an appropriate theoretical model (Noar, 2006). For health communication campaigns focused on health behavior change, individual models of health behavior can be effective. These models of health behavior are typically based on the assumption that individuals weigh the costs and benefits of adhering to a recommended behavior before making a decision about that behavior. One model involving costs and benefits is the Health Belief Model. The Health Belief Model was originally developed in the 1950s by social psychologists working for the U.S. Public Health Service. They hoped that by developing the model, they could determine why people were not taking part in programs...
designed to prevent and detect diseases such as tuberculosis (Hochbaum, 1958; Rosenstock, 1960, 1974).

This model posits that the presence of three beliefs in individuals predicts their likelihood of taking the recommended health actions. According to the Health Belief Model (HBM), in order for individuals to take action they must first believe that they are susceptible to the condition, then believe that the condition can have serious consequences, and lastly believe that the potential benefits of taking action outweigh the anticipated costs of the actions (Rosenstock, 1974).

The Health Belief Model has been applied to many types of health campaigns. One health issue with extensive research involving the Health Belief Model is breast cancer screening (Champion, 1984; Champion and Menon, 1997; Champion, Ray, Heilman and Springston, 2000). In breast cancer screening research, researchers found that when perceived susceptibility was high and benefits outweighed the costs, participants were more likely to comply with mammogram recommendations (Champion, 1984; Champion and Menon, 1997; Champion, Ray, Heilman, and Springston, 2000). Recent studies on mammography adherence have also found success in using HBM constructs to tailor messages to those at risk (Skinner, Strecher, and Hospers, 1994; Champion et. al, 2006; Champion et. al, 2007).

Although the Health Belief Model has been found to be effective in predicting the likelihood of individuals taking recommended action, the model is limited in that its original form overlooks the importance of efficacy in behavior change. Rogers’ Protection Motivation Theory (PMT) builds from previous research in adding the missing element of efficacy to risk perception.
PMT posits that there are two key elements to risk perception: threat appraisal and coping appraisal. According to Rogers’ model, threat appraisal is determined by perceived severity and perceived vulnerability to a particular threat. Coping appraisal is comprised of self-efficacy, how able a person thinks he or she is to perform a task, and response efficacy, how likely a person believes his or her actions will result in the desired outcome. The highest levels of risk perception would occur when a person perceives high levels of both severity and vulnerability in reference to a particular threat; a person will likely take action when there are high levels of perceived threat in addition to high levels of self-efficacy and response efficacy (Rogers, 1975).

PMT has been used in several types of health campaigns (Floyd, Prentice-Dunn & Rogers, 2000; Milne, Sheeran, & Orbell, 2000). With its inclusion of the component of efficacy, PMT has been widely successful when applied to health campaigns in which researchers aim to get participants to adopt a new healthy behavior, such as performing self-exams for breast cancer detection (Rippetoe & Rogers, 1987), adopting physical exercise (Stanley & Maddux, 1986), and preventing AIDS-related risk behaviors (van der Velde & van der Pligt, 1991).

While models such as PMT focus greatly on risk perception cognitions, they are limited by the fact that they lack an emotional component. A new model emerging a decade later built on previous risk perception research by adding the missing component of emotion and its role in risk. Witte’s Extended Parallel Processing Model (EPPM) focuses on fear appeals within the framework of risk perception. Specifically, the goal of EPPM is to determine the conditions that need to be met in order for a fear appeal to be successful. Witte found that when the threat appraisal of a message and the efficacy
Witte’s model incorporates many components from previous models. According to Witte’s model, the threat of a message contains two components: perceived susceptibility and perceived severity. Additionally, Witte’s model contains two elements for efficacy: self-efficacy and response efficacy (Witte, 1994).

Witte’s model posits that there are three types of responses that occur as a result of perceived efficacy and perceived threat: no response, message acceptance, or message rejection. Witte states that there are two types of appraisal processes that lead to these responses: the danger control process and the fear control process. The fear control process occurs when the perceived threat is high and perceived efficacy is low. In this situation an individual will have defensive avoidance and will reject the message, resulting in maladaptive change. Contrastingly, when an individual perceives a threat as high and efficacy as high, he or she will engage in the danger control process. In this scenario, an individual accepts the message and will consider behavioral actions that correspond to the message, causing an adaptive change (Witte, 1994).

Witte’s model is backed by substantial empirical evidence. Botta et al. (2008) used EPPM to design a campaign to increase hand washing in a university. By posting high-threat and high-efficacy messages in university bathrooms, researchers observed an 8% increase in hand washing in male university students and a 26% increase in hand washing in female university students (Botta et. al, 2008). McKay et al. (2004) used the principles of EPPM to design a study in which participants, older adults at risk for cardiovascular disease, read pamphlets with different levels of risk and efficacy. Researchers found that those who had not been taking preventative actions against
cardiovascular disease were most influenced by the high-efficacy and high-threat message and, in turn, reported higher levels of self-efficacy and response-efficacy as a result of message exposure (McKay et. al, 2004).

Although Witte’s model does provide insight into how fear leads to emotional responses that promote either maladaptive or adaptive behaviors, it has limitations. Witte’s model focuses on threat as a message attribute while failing to account for perceived risk as a feature inherent to individuals. Therefore, in focusing on message features, EPPM suggests that everyone will follow the same path rather than distinguishing between those individuals with differing levels of perceived risk and efficacy. This is an imprecise assumption.

Rimal’s Risk Perception Attitude Framework (RPA) builds from Witte’s EPPM to provide a model accounting for individual differences in perceived risk and efficacy. According to Rimal, the major difference between EPPM and RPA is that “in the former, efficacy beliefs are not deemed to be important when risk perceptions are low, whereas in the latter, efficacy beliefs are thought to be important regardless of whether risk perceptions are high or low” (Rimal, 2003 p.1). In other words, unlike EPPM, Rimal’s model emphasizes the importance of efficacy beliefs in both high and low risk conditions.

In creating his framework of risk perception Rimal constructed four conditions based on evaluations of efficacy and risk. The first condition, known as the “indifferent attitude,” displays low efficacy beliefs and low risk beliefs. The second condition, “avoidance attitude,” demonstrates low efficacy beliefs and high risk beliefs. The third condition, “proactive attitude,” exhibits high efficacy beliefs and low risk beliefs. The fourth condition, “responsive attitude,” is characterized by both high efficacy and high
risk beliefs and is therefore the most likely to respond to fear appeal messages (Rimal, 2003).

To test his framework Rimal conducted a research study focusing on risk perceptions about maternal health problems in Burkina Faso. Rimal conducted a campaign aimed at increasing the participants’ knowledge of maternal health issues. He used surveys to measure the following items as a pre-test and post-test: perceived risk, efficacy beliefs, RPA group classification, information seeking, “knowledge of maternal health problems,” and “behavior regarding care seeking for maternal health.” Rimal found that the four RPA groups differed in terms of knowledge gain. Another finding of the study was that RPA classification moderated the relationship between knowledge gain and change of behavior (Rimal, 2003).

Rimal’s framework consisting of four RPA groups has traditionally been used in measuring the effects of programs or messages. In a field study on workplace safety, Real successfully predicted the safety outcomes of manufacturing workers by using RPA framework (Real, 2007). Nan et. al used RPA to examine cancer information seeking. They found that there was a significant difference in individuals within the different RPA groups in information seeking behavior (Nan et. al, 2009).

However, because Rimal’s model naturally segments the audience, it could also be used to tailor messages to target individuals within each condition. In a recent study conducted by Rimal, researchers used tailoring based on RPA classification in order to tailor interventions aimed at preventing the spread of HIV in Malawi. Rimal found that tailoring an intervention based on RPA classification was effective. Rimal states, “The risk perception attitude framework can serve as a theoretically sound audience
segmentation technique that can be used to determine whether messages should augment perceptions of risk, beliefs about personal efficacy, or both” (Rimal, 2009, p.2224).

Message Tailoring

Message tailoring involves designing persuasive health messages intended for the individual rather than for a group as is the focus of traditional message development (Noar et. al, 2009). In order to tailor a message, researchers assess individuals and place them into categories based on results. Messages are then tailored based on the individual needs of members in each category (Noar et. al, 2009).

The importance of tailoring health communication messages is backed by empirical support (Champion et. al 2006, Champion et. al, 2007; Noar et. al, 2009; Skinner, Strecher, and Hospers, 1994). Researchers have found success in tailoring messages based on HBM constructs in order to encourage preventive breast cancer screening. Skinner, Strecher, and Hospers (1994) looked at 435 female family practice patients. Researchers randomly assigned participants to one of two conditions. In the first condition the participants received a tailored letter addressing specific barriers to mammograms as mentioned by the women. In the second condition, the participants received a nontailored version of the letter addressing three common barriers. Researchers found that mammography adherence was significantly higher among those receiving the HBM tailored letters than those receiving the nontailored letters (Skinner, Strecher, and Hospers, 1994). Researchers have also found success in mammography adherence by tailoring telephone counseling and interactive computer programs based on HBM constructs (Champion et. al, 2006; Champion et. al, 2007).
PAVE Creative Group and Sleep Solutions’ NovaSom Project

PAVE Creative Group, a Winston-Salem, North Carolina firm focusing in public relations, interactive communications, branding, and content and image design, is in charge of website design for an at-home diagnostic for OSA, Sleep Solutions’ NovaSom. NovaSom is a physician-prescribed diagnostic consisting of sensors which measure a person’s “breathing, oxygen level, pulse rate, chest movement and snoring (if any)” (www.apnea.com). Patients return the physician-prescribed diagnostic to Sleep Solutions after the test’s completion. Results are later sent to a patient’s doctor for review.

This research study will be conducted through Sleep Solutions’ website, www.apnea.com, in cooperation with PAVE Creative Group. Specifically, this study will focus on the interactive risk assessment portion of the website which was designed to help website visitors to determine if they are susceptible to OSA. The risk assessment looks at information such as demographics, quality of sleep, and other factors used to assess the presence of OSA. This study will expose survey participants to banner ads tailored to their perceived risk.

Rationale for the Use of Tailored Messages Based on Rimal’s RPA

The literature suggests that message tailoring can be an effective tactic in designing health interventions. Recent research suggests that Rimal’s RPA classifications can be easily and effectively used as an audience segmentation and tailoring tool (Rimal, 2009).

In this particular project, RPA tailoring will be applied in the following manner. After answering questions related to perceived risk and efficacy, individuals in the test condition would be placed into one of the four groups based on their survey responses.
Individuals in the two groups with low perceived risk, “indifferent” and “proactive” classifications, would receive a high risk message with an efficacy component. Those in the two groups with high perceived risk, “avoidant” and “responsive” classifications, would receive an efficacy-only message since they already have high perceived risk. All classifications would receive a message with an efficacy component in order to accurately correspond with the assumption of Rimal’s model that efficacy is an important element of a message no matter the condition of the participants (Rimal, 2003).

Hypotheses and Research Questions

To my knowledge no research to date has attempted to tailor messages based on the four RPA groups through a web-based intervention. This study represents a first attempt to test the effects of exposing members of the four classifications to messages specifically tailored for the beliefs of their particular classification in order to address the problem of under-diagnosis of obstructive sleep apnea. This study aims to determine if tailored messages based on RPA classification can increase participants’ intentions to visit a physician about OSA. A secondary aim of this research is to better understand important relationships related to message tailoring including risk perception, efficacy perception, perceived barriers, and demographic variables.

In order to determine the effect of exposure of RPA tailored messages on participants’ intentions to visit a physician about OSA, the following hypothesis and research questions are proposed.

H1: Participants exposed to tailored banner ads will have stronger intentions to visit a physician about OSA than will participants in the control group.
This first hypothesis will examine the effect of message tailoring on intentions to visit a physician about OSA. This will provide information regarding the usefulness of this tactic in future campaigns concerning OSA.

To better understand the potential of targeting messages to specific races and genders, the following research questions are proposed:

RQ1  a: Will men and women differ in their intentions to visit a physician?
    b: Will participants in different racial groups differ in their intentions to visit a physician?
    c: Will men and women differ in their perceptions of risk and efficacy?
    d: Will participants in different racial groups differ in their perceptions of risk and efficacy?

To further understand the potential of targeting messages based on health communication models, the following research question is proposed:

RQ2: To what extent do risk perceptions, efficacy perceptions, and perceived barriers predict intentions to see a physician?

Answering this research question is important because it will indicate whether RPA categories or barriers, which are crucial to applying the HBM, are valuable in campaigns using targeting related to OSA.
Participants and Procedures

Participants in this study were visitors to Sleep Solutions’ website who opted to fill out an OSA risk survey. It was expected that most of the participants would fall within the target audience for OSA (middle-aged males) since participants likely found the website while seeking out information about the condition.

When accessing the risk assessment, participants were randomly assigned to one of two conditions: a matched ad condition and a general ad condition. Participants in both conditions answered a four page survey. During the first page of the survey, participants answered questions relating to perceived risk and perceived efficacy based on Rimal’s RPA framework. On the second page of the survey, participants answered questions about demographic information including age, sex, and race. On the third page of the survey, participants responded to questions intended to assess actual risk using two different established risk assessments for OSA. On the fourth screen, participants responded to a question about intentions to visit a physician about OSA. At the end of the survey, all participants received an actual risk assessment they could take to a doctor in order to assist in diagnosing OSA.

For those in the matched condition, a tailored ad appeared after the first screen in order to correspond with participants’ perceived risk. Those who had low perceived risk received a message to convey high risk. Conversely, those who had high perceived risk received only an efficacy message since their risk was already at a responsive level. Based on the importance of efficacy emphasized in Rimal’s RPA framework, all participants received an efficacy message (Rimal, 2003). After the second screen, the
tailored ad incorporated gender and race to match responses provided by participants. After completion of the third screen, the tailored ad reflected actual risk responses provided by the participants. The matched condition participants then responded to a question about intention to visit a physician. In the end, participants received an actual risk assessment to take to a physician (see Figure 1 on the following page).

For those in the unmatched condition, a general ad appeared throughout the entire survey. The general message was of an informative nature, informing participants about the home diagnostic NovaSom. This message did not convey risk or efficacy and did not feature images of people. Participants in this condition responded to the same intention question as the matched condition and received an actual risk assessment to take to a physician.
Figure 1: Diagram of Matched Condition Survey
Design

This study examined the relationship between exposure to a tailored banner ad and intentions to visit a physician about OSA. Participants were randomly assigned into either the test condition or the control group depending upon when they accessed the survey. The random assignment worked by placing every other participant accessing the survey into the test condition while others were assigned into the control group.

The survey questions pertaining to perceived risk and efficacy used in the risk assessment were based on Rimal’s study involving maternal health in Burkina Faso (Rimal, 2003). The questions, designed on a 5-point Likert-type scale, were formulated to measure perceived risk, comprised of perceived severity and susceptibility, and perceived efficacy, comprised of perceived self-efficacy and response efficacy.

Independent variables

*Condition (Exposure to tailored ad vs. exposure to generic ad).* Participants were randomly assigned to either a test condition or a control group. Participants in the tailored ad condition received banner ads tailored first to perceived risk and efficacy, then to perceived risk and efficacy and demographic information, and finally to perceived risk and efficacy, demographic information, and actual risk. Participants in the control group received a general banner ad throughout. This ad did not have any risk or efficacy components.

Participants were randomly assigned to either the treatment condition or the control group based upon when they accessed the survey. Overall, 138 valid survey responses were received over the two weeks in which the survey was online. The valid
responses showed that 76 of the participants (55%) were assigned to the treatment condition while 62 participants (44.9%) were assigned to the control group.

At pre-test, all participants responded to questions on perceived risk and perceived efficacy before message exposure. Two independent samples t-tests were conducted to ensure that the participants did not differ significantly on perceived risk and perceived efficacy at pre-test. An independent samples t-test revealed no significant difference between the two groups on perceived risk at pre-test, $t(136) = .60, p = .54$. A second independent samples t-test revealed no significant difference between the two groups on perceived efficacy at pre-test, $t(136) = -.50, p = .619$.

**Perceived risk.** Participants in both conditions were asked to respond to six Likert type questions about their perceived risk of OSA based on Rimal’s Risk Perception Attitude Framework research. Three of the questions pertained to perceived severity (e.g. “In your opinion, how severe are the consequences of OSA?”). The other three questions were based on perceived susceptibility (e.g. “In your opinion, how likely are you to be suffering from obstructive sleep apnea (OSA?”). The perceived risk scale was constructed by taking the means of participants’ responses to the six questions. Higher scores were interpreted as higher levels of perceived risk. The perceived risk scale was reliable ($M = 3.13, SD = .86, \alpha = .76$).

**Perceived Efficacy.** Participants in both conditions responded to four Likert type questions about perceived efficacy. Two of the questions pertained to perceived self-efficacy (e.g. “How easy would it be for you to visit a physician about OSA?”). The other two questions were based on perceived response efficacy (e.g. “How confident are you that completion of a physician-prescribed home sleep study would properly diagnose
The perceived efficacy scale was constructed by taking the mean of participants’ responses to the four efficacy questions. Higher scores were interpreted as indicating higher levels of perceived efficacy. The perceived efficacy scale was reliable ($M = 3.74$, $SD = .96$, $\alpha = .75$).

**Barriers.** Participants in both conditions were asked to respond to eight Likert type questions about perceived barriers that might prevent them from seeing a physician to discuss diagnostic options for OSA. In this portion of the survey, participants were instructed to respond to eight potential barriers such as “cost of the test” and “the test seems complicated” and then asked to answer if the barriers were “unimportant,” “somewhat unimportant,” “somewhat important,” “important,” or “very important.” The barrier scale was constructed by taking the mean of participants’ responses to the eight barrier questions. Higher scores were interpreted as indicating higher intensity of barriers. The barrier scale was reliable ($M = 1.86$, $SD = .93$, $\alpha = .87$).

**Race.** All participants were asked to respond to a question asking them to identify their race. The options were: “Caucasian,” “Asian-American,” “African-American,” “Latino/Hispanic,” and “other.” The valid responses showed that 120 participants (87%) identified themselves as Caucasian while 13 participants (9.4%) were African-American, three participants (2.2%) were Asian-American, and two participants (1.4%) chose the category of “other.” None of the participants identified themselves as Latino/Hispanic. Since there were so few non-Caucasian respondents, the racial categories were condensed into “Caucasian” ($n = 120$) and “Non-Caucasian” ($n = 18$) for future analyses.
Gender. All participants were asked to respond to a question to identify their gender as either “female” or “male.” There were 70 male participants (50.7%) and 68 female participants (49.3%).

Dependent variables

Intention to visit a physician. After completing the four page survey, participants in both conditions were asked to respond to a question about their intentions to visit a physician to discuss OSA. Participants answered a “yes” or “no” question about their intentions to visit a physician about OSA (e.g. “Do you intend to visit a physician about OSA?”). If the participants answered “no,” they were immediately directed to their results.

If the participants answered “yes,” they were asked to answer how soon they intended to visit a physician about OSA. The options were: “within one week,” “within one month,” “within two months,” “within three months,” or “within six months.” Those who responded “one week” or “one month” were considered to have stronger intentions than those responding “three months” or “six months.”

The two questions were combined so that a participant answering “no” to the first question was coded as a “0.” Participants answering “six months” were coded as a “1.” An answer of “three months” was coded as a “2.” “Two months” was coded as a “3.” “One month” was coded as a “4.” “One week” was coded as a “5.” Higher scores were interpreted as stronger intentions to visit a physician.

In order to ensure that the intention variable ($M = .52$, $SD = 1.31$) had a normal distribution, tests for skewness and kurtosis were conducted. The intention variable was not normally distributed (skewness = 2.51, kurtosis = 5.03). According to Field, a normal
distribution should have a value of zero for both skewness and kurtosis. Having skewness and kurtosis values that are not equal to zero signifies a deviation from a normal distribution which is not ideal for data analysis (Field 2005). Consequently, the Likert type intention variable was dropped and the nominal responses to the first “yes” or “no” question were used for all relevant analyses. There were 115 participants (77.7%) who responded “no,” 23 participants (15.5%) who responded “yes,” and ten participants (6.8%) who did not choose an answer and were therefore not included in relevant analyses.

**Perceived risk.** The same perceived risk scale used as an independent variable was also used as a dependent variable in this study ($M = 3.13, SD = .86, \alpha = .76$).

**Perceived efficacy.** The same perceived efficacy scale used as an independent variable was also used as a dependent variable in this study ($M = 3.74, SD = .96, \alpha = .75$).

**Data Analysis**

In order to test for the first hypothesis predicting that participants in the test condition would exhibit stronger intentions to visit a physician than would participants in the control group, a chi-square test was conducted. To explore the first research question, which sought to determine whether participants of different genders and races would differ significantly on the outcomes of intention to visit a physician, risk perception, and efficacy perception, two chi-square tests and four independent-samples $t$-tests were conducted. In answering the second research question, which sought to determine the extent to which risk perceptions, efficacy perceptions, and perceived barriers could
predict intentions to visit a physician, a point biserial correlation and two logistic regressions were conducted.

Summary of aims and purpose

The primary aim of the analyses was to determine whether message tailoring through a web-based campaign could increase participants’ intentions to visit a physician about OSA. The secondary aims of the analyses were to identify important relationships related to message tailoring including risk perception, efficacy perception, perceived barriers, and demographic variables. The overall purpose of the study was to determine how a health communication campaign can effectively address the problem of under-diagnosis of OSA.
CHAPTER THREE: RESULTS

Data Analysis

Hypothesis 1

The first hypothesis predicted that participants exposed to tailored messages would exhibit stronger intentions to visit a physician than would those in the control group. In order to test for this hypothesis, a chi-square test was conducted. The purpose of this test was to determine if those in the control group differed significantly from those in the test group in intentions to visit a physician. The independent variable used in this test, exposure to tailored messages, compared those in the test condition, who were exposed to tailored messages, to those in the control group, who were not exposed to tailored messages. The dependent variable, intention to visit a physician about OSA, was measured by a question at the end of the survey asking participants whether they intended to visit a physician. Participants responded either “yes” or “no.”

The chi-square test indicated that the percentage of participants that intended to see a physician about OSA did not differ significantly by condition, $\chi^2 (1, N = 138) = 2.34, p = .13$. Table I displays frequencies and percentages for the intentions of the treatment and control groups.
Table I: Chi-Square Results for Intentions of Participants in Both Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Treatment</th>
<th>Count</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>60</td>
<td>16</td>
<td>76</td>
</tr>
<tr>
<td>% within Condition</td>
<td></td>
<td>78.9%</td>
<td>21.1%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>% within Intention to See a Physician</td>
<td></td>
<td>52.2%</td>
<td>69.6%</td>
<td>55.1%</td>
<td></td>
</tr>
<tr>
<td>% of Total</td>
<td></td>
<td>43.5%</td>
<td>11.6%</td>
<td>55.1%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control</th>
<th>Count</th>
<th>55</th>
<th>7</th>
<th>62</th>
</tr>
</thead>
<tbody>
<tr>
<td>% within Condition</td>
<td></td>
<td>88.7%</td>
<td>11.3%</td>
<td>100.0%</td>
</tr>
<tr>
<td>% within Intention to See a Physician</td>
<td></td>
<td>47.8%</td>
<td>30.4%</td>
<td>44.9%</td>
</tr>
<tr>
<td>% of Total</td>
<td></td>
<td>39.9%</td>
<td>5.1%</td>
<td>44.9%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total</th>
<th>Count</th>
<th>115</th>
<th>23</th>
<th>138</th>
</tr>
</thead>
<tbody>
<tr>
<td>% within Condition</td>
<td></td>
<td>83.3%</td>
<td>16.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>% within Intention to See a Physician</td>
<td></td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>% of Total</td>
<td></td>
<td>83.3%</td>
<td>16.7%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Research Question 1a

The first research question sought to determine if the outcomes of risk perception, efficacy perception, and intention to visit a physician differed significantly for participants of different genders and racial groups. In order to determine if men and women differed in intention to visit a physician, a chi-square test was conducted with gender as the independent variable and intention to visit a physician as the dependent variable.
The chi-square test indicated that the percentage of participants that intended to visit a physician differed significantly by gender $\chi^2 (1, N = 138) = 5.94, p < .05$, with a higher percentage of men intending to visit a physician than women. The table below displays frequencies and percentages for the intentions of male and female participants.

Table II: Chi-Square Results for Intentions of Male and Female Participants

<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>53</td>
<td>17</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>62</td>
<td>6</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
<td>23</td>
<td>138</td>
<td></td>
</tr>
</tbody>
</table>

- % within Gender: Male = 75.7%, Female = 91.2%, Total = 83.3%
- % within Intention to See a Physician: Male = 46.1%, Female = 53.9%, Total = 100.0%

Research Question 1b

To determine whether participants in different racial groups differed in intention to visit a physician, a chi-square test was conducted. The purpose of this test was to determine if participants in different racial groups had a difference in intention to visit a physician for participants in both conditions.
The chi-square test indicated that the percentage of participants that intended to visit a physician differed significantly by race, $\chi^2 (1, N = 138) = 11.5, p < .01$, with a higher percentage of non-Caucasians intending to see a physician compared to Caucasians. The table below displays the percentages and frequencies for intention to visit a physician for Caucasian and non-Caucasian participants.

Table III: Chi-Square Results for Intentions of Caucasian and Non-Caucasian Participants

<table>
<thead>
<tr>
<th>Race</th>
<th>Intention to See a Physician</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Caucasian</td>
<td>105</td>
<td>15</td>
</tr>
<tr>
<td>% within Race</td>
<td>87.5%</td>
<td>12.5%</td>
</tr>
<tr>
<td>% within Intention to See a Physician</td>
<td>91.3%</td>
<td>65.2%</td>
</tr>
<tr>
<td>% of Total</td>
<td>76.1%</td>
<td>10.9%</td>
</tr>
<tr>
<td>Non-Caucasian</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>% within Race</td>
<td>55.6%</td>
<td>44.4%</td>
</tr>
<tr>
<td>% within Intention to See a Physician</td>
<td>8.7%</td>
<td>34.8%</td>
</tr>
<tr>
<td>% of Total</td>
<td>7.2%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
<td>23</td>
</tr>
<tr>
<td>% within Race</td>
<td>83.3%</td>
<td>16.7%</td>
</tr>
<tr>
<td>% within Intention to See a Physician</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>% of Total</td>
<td>83.3%</td>
<td>16.7%</td>
</tr>
</tbody>
</table>
Research Question 1c

After running analyses to explore whether a difference existed in intention to visit a physician for participants of different genders and racial groups, four additional analyses were conducted to determine if participants of different genders and racial groups differed significantly on risk perception and efficacy perception.

To determine if men and women differed significantly in risk perception, an independent-samples $t$-test was conducted with gender as the independent variable and risk perception as the dependent variable. This independent-samples $t$-test was not significant, $t (136) = .994, p = .32$. The results indicated that female participants ($M = 3.05, SD = .79$) did not differ significantly from male participants ($M = 3.20, SD = .93$) on perceived risk. Therefore, risk perception was not significantly different in participants of different genders.

To determine if men and women differed significantly in efficacy perception, an independent-samples $t$-test was conducted with gender as the independent variable and efficacy perception as the dependent variable. This independent-samples $t$-test was not significant, $t (136) = -1.49, p = .14$. The results indicated that female participants ($M = 3.86, SD = .95$) did not differ significantly from male participants ($M = 3.62, SD = .96$) on perceived efficacy. Therefore, efficacy perception was not significantly different in participants of different genders.

Research Question 1d

To explore whether racial groups differed significantly in risk perception, an independent-samples $t$-test was conducted with the independent variable as race and dependent variable as risk perception. This independent-samples $t$-test was not
significant, $t(136) = -1.23, p = .22$. Participants in the “Caucasian” category ($M = 3.09, SD = .83$) did not differ significantly from those in the “Non-Caucasian” category ($M = 3.36, SD = 1.06$) on perceived risk. Therefore, risk perception was not significantly different in participants of different racial groups.

To determine whether racial groups differed significantly in efficacy perception, an independent-samples $t$-test was conducted with the independent variable as race and the dependent variable as efficacy perception. This independent-samples $t$-test was not significant, $t(136) = .35, p = .73$. Participants in the “Caucasian” category ($M = 3.75, SD = .94$) did not differ significantly from those in the “Non-Caucasian” category ($M = 3.67, SD = 1.10$) on perceived efficacy. Therefore, efficacy perception was not significantly different in participants of different racial groups.

**Research Question 2**

The second research question sought to examine the extent to which risk perceptions, efficacy perceptions, and perceived barriers predicted intentions to visit a physician. The first step in examining this research question was to explore the relationships among the variables by computing point biserial correlations. The first point biserial correlation was constructed to include the RPA framework components of risk perceptions and efficacy perceptions (see Table IV).
Table IV: Correlation Table for Intention to See a Physician, Perceived Risk, and Perceived Efficacy

<table>
<thead>
<tr>
<th></th>
<th>Intention to See a Physician</th>
<th>Perceived Risk</th>
<th>Perceived Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to See a Physician</td>
<td>Pearson Correlation</td>
<td>1</td>
<td>.322**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.602</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>138</td>
<td>138</td>
</tr>
<tr>
<td>Perceived Risk</td>
<td>Pearson Correlation</td>
<td>.322**</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.009</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>138</td>
<td>138</td>
</tr>
<tr>
<td>Perceived Efficacy</td>
<td>Pearson Correlation</td>
<td>.045</td>
<td>.223**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.602</td>
<td>.009</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>138</td>
<td>138</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).

Because perceived efficacy was not significant, it was necessary to examine the sub-scales within perceived efficacy, perceived self-efficacy and perceived response efficacy, in order to determine if certain components of efficacy were correlated with intentions to visit a physician although the combined perceived efficacy score was not.

In addition to examining the sub-scales of perceived efficacy, the sub-scales of perceived risk, perceived susceptibility and perceived severity, were also further examined to determine if a particular type of perceived risk was more strongly correlated with intention to visit a physician. The means and standard deviations of the sub-scales are displayed in the table on the following page.
Table V: Means and Standard Deviations for Perceived Efficacy and Perceived Risk Sub-scales

<table>
<thead>
<tr>
<th></th>
<th>Perceived Self-Efficacy</th>
<th>Perceived Response Efficacy</th>
<th>Perceived Severity</th>
<th>Perceived Susceptibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.78</td>
<td>3.78</td>
<td>4.04</td>
<td>2.21</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>1.08</td>
<td>1.08</td>
<td>1.09</td>
<td>1.22</td>
</tr>
</tbody>
</table>

A second point biserial correlation was conducted to examine the relationship of the sub-scales of perceived efficacy and perceived severity to the other variables (see Table VI).

Table VI: Correlation Table for Intention to See a Physician, Perceived Risk, Perceived Efficacy, Perceived Self-Efficacy, Received Response Efficacy, Perceived Susceptibility, and Perceived Severity

<table>
<thead>
<tr>
<th></th>
<th>Intention to See a Physician</th>
<th>Perceived Risk</th>
<th>Perceived Efficacy</th>
<th>Perceived Self-Efficacy</th>
<th>Received Response Efficacy</th>
<th>Perceived Susceptibility</th>
<th>Perceived Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to See a Physician</td>
<td>Pearson Correlation</td>
<td>.322</td>
<td>.045</td>
<td>.010</td>
<td>.016</td>
<td>.470</td>
<td>.016</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.602</td>
<td>.553</td>
<td>.910</td>
<td>.835</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
</tr>
<tr>
<td>Perceived Risk</td>
<td>Pearson Correlation</td>
<td>.223</td>
<td>.066</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.009</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
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<td>Received Response Efficacy</td>
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<td>.000</td>
<td>.000</td>
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<td>Sig. (2-tailed)</td>
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</tbody>
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The correlation matrix indicated that perceived risk and its sub-scale of perceived susceptibility were significantly correlated with intention to visit a physician. Perceived severity, an additional sub-scale of perceived risk, however, was not significantly correlated with intention to visit a physician. As a result, perceived severity was removed from the model and perceived susceptibility was used for further analyses. Perceived efficacy and its components were not significantly correlated with intention to visit a physician. As a result, these efficacy variables were also removed from the model.

In order to determine the probability that participants’ intentions to visit a physician could be predicted by perceived susceptibility, a logistic regression was conducted. The logistic regression was significant, $R^2 = .19$, $\chi^2 (1, N = 138) = 28.5$, $p < .01$. For every one point increase in perceived susceptibility, participants were 2.75 times as likely to report that they intended to visit a physician (OR = 2.75, 95% CI = 1.81-4.18). The tables below include the regression classification and coefficient information.

Table VII: Logistic Regression Classification Table

<table>
<thead>
<tr>
<th>Observed</th>
<th>Predicted</th>
<th>Percentage Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intention to See a Physician</td>
<td>No</td>
</tr>
<tr>
<td>Step 1</td>
<td>Intention to See a Physician</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Intention to See a Physician</td>
<td>Yes</td>
</tr>
<tr>
<td>Overall Percentage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In order to explore the role of barriers in predicting intention to visit a physician, a logistic regression was conducted using the eight barrier items as the independent variables and intention to visit a physician as the dependent variable. Although the barriers scale with all eight items was reliable ($M = 1.86$, $SD = .93$, $\alpha = .87$), the barriers included in the scale were multi-dimensional in that they addressed several different types of barriers. As a result, it was informative to construct a logistic regression model using the eight barrier items to explore the role of individual barriers on intention to visit a physician.

The overall logistic regression model approached significance, $R^2 = .17$, $\chi^2 (1, N = 133) = 14.58$, $p = .07$. In examining the individual predictors of intention to visit a physician, barrier one was the only significant unique predictor of intention to see a physician. For every one point increase in the perception of lack of awareness of the health risks of OSA, participants were 1.56 times as likely to report that they intended to see a physician ($OR = 1.56$, 95% CI= 1.02-2.4). The tables below include the regression classification and coefficient information.

<table>
<thead>
<tr>
<th>Step</th>
<th>Perceived Susceptibility</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Odds Ratio</th>
<th>95% C.I.for EXP(B)</th>
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<tr>
<td></td>
<td></td>
<td>1.012</td>
<td>.213</td>
<td>22.585</td>
<td>1</td>
<td>.000</td>
<td>2.751</td>
<td>Lower: 1.812, Upper: 4.177</td>
</tr>
<tr>
<td>1</td>
<td>Constant</td>
<td>-4.321</td>
<td>.702</td>
<td>37.840</td>
<td>1</td>
<td>.000</td>
<td>.013</td>
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</tr>
</tbody>
</table>
Table IX: Logistic Regression Classification Table

<table>
<thead>
<tr>
<th>Observed</th>
<th>Predicted Intention to see a physician</th>
<th>Percentage Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Step 1 Intention to see a physician</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>20</td>
</tr>
<tr>
<td>Overall Percentage</td>
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<td></td>
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</table>

a. The cut value is .500

Table X: Logistic Regression Coefficients Table

<table>
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<tr>
<th></th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>95% C.I. for EXP(B)</th>
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<tbody>
<tr>
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<td>Step 1a</td>
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<td>barr1</td>
<td>.445</td>
<td>.219</td>
<td>4.137</td>
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<td>.042</td>
<td>1.561</td>
<td>1.016</td>
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<tr>
<td>barr2</td>
<td>-.256</td>
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<td>.259</td>
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<td>.497</td>
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<tr>
<td>barr3</td>
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<td>.749</td>
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<tr>
<td>barr4</td>
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<td>.661</td>
<td>1</td>
<td>.416</td>
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<td>.732</td>
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<tr>
<td>barr5</td>
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<td>.008</td>
<td>1</td>
<td>.927</td>
<td>1.024</td>
<td>.613</td>
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<tr>
<td>barr6</td>
<td>-.284</td>
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<td>.281</td>
<td>.753</td>
<td>.450</td>
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<tr>
<td>barr7</td>
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<td>.348</td>
<td>1</td>
<td>.555</td>
<td>1.218</td>
<td>.632</td>
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<td>barr8</td>
<td>.171</td>
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<td>.495</td>
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<td>.482</td>
<td>1.187</td>
<td>.736</td>
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</table>

a. Variable(s) entered on step 1: barr1, barr2, barr3, barr4, barr5, barr6, barr7, barr8.

In summary, the analyses used to explore the second research question indicated that perceived susceptibility significantly predicted intention to visit a physician. Additionally, the barrier item, “I wasn’t aware of the health risks of OSA,” significantly
predicted intention to visit a physician. However, the perceived efficacy variables and perceived severity variable did not predict intention to visit a physician.
Summary of Findings and Implications

Although the intervention did not significantly increase intentions to visit a physician for participants in the test condition, there are other important implications of this research for message tailoring as it relates to OSA. The research indicated that gender and race had a significant effect on intention to visit a physician. Additionally, the results of this study suggest that targeting perceived susceptibility and increasing awareness of the risks associated with OSA may be important for future campaigns involving this condition.

The first implication of this research, that gender may predict intention to visit a physician related to OSA is informative for targeting purposes of future campaigns. The study indicates that a higher percentage of male participants intended to visit a physician about OSA compared to female participants. Research suggests that females and males differ in actual risk of OSA with females less likely to have the condition than males (Olbrich, Muhlans, Allison, Hahn, Schahin, & Zwaan, 2009; Young, Finn, Austin, and Peterson, 2003). Future targeting efforts could examine why males had greater intentions to visit a physician than females to determine if it is more beneficial to target a particular gender in future interventions.

The second implication of this research, that race may predict intention to visit a physician related to OSA, is also informative for targeting purposes. Research by Sands et. al suggests that racial differences exist in actual risk of OSA (Sands et. al, 2008). Although the role of race in actual risk of OSA has not been conclusively determined, the finding that different races may be more likely to visit a physician about the condition...
could help in future targeting efforts. For example, if certain racial groups are more likely to have OSA, those with high levels of actual risk but low levels of perceived risk could be targeted in a campaign.

The third implication of this research, that perceived susceptibility may predict intention to visit a physician related to OSA, can also be informative for targeting purposes. OSA is a complicated condition that is vastly under-diagnosed and continues to grow in prevalence yet has not been thoroughly studied from a health communication perspective. This study suggests that the role of perceived susceptibility may be important in influencing intentions to visit a physician about this condition. Although health communication models suggest that perceived severity and perceived susceptibility are both important elements in risk perception, this study suggests that in the under-diagnosis of OSA, perceived susceptibility may be a more effective targeting variable.

Lastly, the finding that responses to the barrier question “I wasn’t aware of the health risks associated with OSA” positively predicted intention to visit a physician is informative for future interventions involving OSA. This finding indicates that a lack of awareness of the general health risks associated with OSA was a significant barrier to seeking diagnosis. If not being aware of the health risks associated with OSA is a barrier to visiting a physician about the condition, interventions designed to educate participants of the risks of OSA might be effective in increasing intentions to visit a physician.

Limitations

Although this research study was able to shed light on its secondary aims, there are some possible explanations of why it did not reach its primary aim of influencing
intentions to visit a physician through message tailoring. One limitation of the study was that the risk and efficacy messages were conveyed through banner ads for which there was not a measure of attention. These banner ads to which the participants in the test condition were exposed were located on the right side of the survey page. Participants may not have seen the banner ads or may not have paid attention to the messages and images. As a result, the messages may not have influenced participants in the test condition simply because they did not notice them.

Another explanation for why the banner ads may not have been effective in increasing intentions to visit a physician can be explained by Petty and Cacioppo’s Elaboration Likelihood Model of Persuasion (ELM). According to ELM, persuasive messages are processed through either a central route or a peripheral route. In the central route, a message is carefully evaluated and scrutinized. If a person processes a message through the central route, he or she is more likely to have a strong attitude change. However, in the peripheral route, a person does not elaborate on the message and relies instead on environmental cues such as images or slogans. If a person processes a message through the peripheral route, he or she is more likely to have a weak attitude change if any (Petty, 1981).

Participants in this study were not likely processing the banner ads through the central route, since these ads did not appear as the main focus of the survey. Consequently, participants viewing these banner ads may have had little or no attitude change. In order to encourage central processing of the messages, it might have been beneficial to embed risk and efficacy messages in a written paragraph during part of the survey.
In addition to the limitations posed by the banner ad format of the messages, additional limitations were present due to the participants involved. Although 138 valid responses were collected, a larger sample size of 200 or more participants may have yielded more generalizable findings. Additionally, although significant differences in intentions to visit a physician for different racial groups was found, more racial diversity in the study may have yielded more conclusive results about specific racial groups.

In addition to the limitations of the study format and participants, another limitation of the study was the type of risk targeted in the intervention. While this study focused on cognitive risk, some research suggests that anxiety-related affect, referred to as “worry,” may be a stronger motivator for health behavior change than cognitive risk (Cameron, 2003; Diefenbach et. al., 1999; McCaul et. al., 1996).

**Directions for Future Research**

As health communication research involving OSA continues to evolve, this study suggests that the role of gender and race in intention to visit a physician about OSA should be further explored. The role of gender in intention to visit a physician about OSA could be examined to determine the possible causes for differences. This information would be informative for future targeting efforts.

Future research could explore the role of race in intention to visit a physician about OSA by incorporating more racial diversity in participants. Because this study had so few participants in the categories of “African-American,” “Asian-American,” and “other,” it was necessary to collapse participants into two groups: “Caucasian” and “Non-Caucasian.” Additionally, although there was a “Hispanic/Latino” category, no respondents selected this option. By examining intentions across a greater number of
racial groups, researchers could more thoroughly determine which racial groups are more likely to visit a physician about OSA. Additionally, as research evolves in racial differences in actual risk of OSA, researchers could target campaigns around specific racial groups that may have higher actual risk but lower perceived risk.

Another important consideration in future research is the role of perceived susceptibility in intentions to visit a physician about OSA. While this study included elements of perceived susceptibility and perceived severity in high risk tailored messages, for targeting efforts involving OSA, the findings suggest that a focus on perceived susceptibility may be most effective.

The findings also suggest that lack of awareness of the health risks associated with OSA may be a significant barrier in intentions to visit a physician. These findings suggest that future interventions involving OSA could benefit from an emphasis on raising awareness of the health risks involved in the condition.

Additionally, future research could also further examine the role of perceived efficacy on intentions to visit a physician about OSA. Although the literature emphasizes the importance of perceived efficacy in health behavior change, this study did not find a significant effect for perceived efficacy (or any of its components) on intention to visit a physician. Future research could explore how efficacy relates to intentions involving OSA to determine whether it is important and, if so, how it can be applied in future studies.

In addition to directions for future research involving OSA, this study also has implications for future health communication studies involving web-based interventions. While this study relied on banner ads to convey messages to participants, this may not
have been an effective method to communicate risk and efficacy. Future research studies
could explore the role of banner ads in web-based interventions to determine if they are
effective when compared to other methods of direct messaging. Specifically, in order to
better assess attentional processes to messages, a more controlled experiment could be
conducted. This experiment could test the recall of messages as presented in a web-based
survey format compared to messages presented in a standard paper survey format.
Additionally, this experiment could compare written messages to verbal messages within
the two survey formats to determine if attentional processes differ for different message
types within the survey formats.

Although this thesis did not find significant effects for the main hypothesis, the
implications of the secondary findings are informative in future targeting campaigns for
OSA. As OSA continues to grow in prevalence, there will be an increased importance
for further health communication campaign efforts to address the vast under-diagnosis of
this deadly condition.
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