ABSTRACT

Using the Health Belief Model to Understand Cholesterol and Blood Pressure Screenings in Rural Populations in Central Texas

Tiffany A. Rose, M.P.H.

Thesis Chairperson: M. Renée Umstattd Meyer, Ph.D.

The purpose of this research was to develop and test Health Belief Model (HBM) construct scales to understand cholesterol screening behavior in rural communities in central Texas. A survey was developed using modified verisons of cancer screening surveys. The resulting 67-item survey instrument was disseminated to three rural communities through school districts, churches, and community programs. Of the 1,125 survey dissemenated, 170 were returned (15.1%). Exploratory Factor Analysis confirmed the following scales: susceptibility (7 items), severity (3 items), benefits (4 items), barriers (6 items), and self-efficacy (6 items). Logistic regression was conducted for meeting cholesterol guidelines and intention to screen using HBM constructs and demographic and health variables. The final model for meeting cholesterol guidelines included perceived barriers, insurance, age, disease index, and BMI. The final model for intention included race/ethnicity, age, and BMI. This study supports the use of HBM constructs to understand cholesterol screening behavior in rural communities.

Using the Health Belief Model to Understand Cholesterol and Blood Pressure Screening in Rural Communities in Central Texas

by

Tiffany A. Rose, B.S.

A Thesis

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W. Dale Connally Ph.D., Chairperson

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Approved by the Thesis Committee

____
M. Renee Umstattd Meyer, Ph.D., Chairperson

____
Eva I. Doyle, Ph.D.

____
Mark F. Taylor, Ph.D.

Accepted by the Graduate School
May 2012

____
J. Larry Lyon, Ph.D., Dean

Page bearing signatures is kept on file in the Graduate School.

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LIST OF ABBREVIATIONS

AHA	American Heart Association
BA	Barriers
BN	Benefits
BRFSS	Behavioral Risk Factor Surveillance System
CAROSS	Carotid plaque screening on Smoking
CDC	Center for Disease Control
CHD	Coronary Heart Disease
CRC	Colorectal Cancer
CVD	Cardiovascular Disease
FHQ	Food Habits Questionnaire
HA/S	Heart Attack or Stroke
HBCVD	Health Beliefs related to Cardiovascular Disease
HBM	Health Belief Model
HDL	High-Density Lipoprotein
HINTS	Health Information National Trends Survey
HPV	Human Papillomavirus
HONU	Heart of New Ulm
LDL	Low-Density Lipoprotein
MEPS	Medical Expenditure Panel Survey
PAPM	Precaution Adoption Process Model
PCP	Primary Care Physician

SE	Self-Efficacy
SS	Susceptibility
SV	Severity
TC	Total Cholesterol
TG	Triglycerides
TPB	Theory of Planned Behavior
TTM	Transtheoretical Model
UMMHC	UMass Memorial Health Care System

LIST OF TERMS

Behavioral Risk Factor Surveillance System (BRFSS): is an annual, state-based system of telephone surveys that was developed by the Center for Disease Control (CDC) in 1984 to collect information on health risk behaviors, preventative health practices and healthcare access primarily related to chronic disease and injury from all 50 states (CDC, 2011).

Health Belief Model (HBM): is a theoretical model developed by Rosenstock and Hochbaum established in the 1950s to understand why people were not participating in available programs to detect disease (Champion * Skinner, 2008).

High-Density Lipoprotein (HDL): a complex lipoprotein whose function is associated with reverse cholesterol transport, blocking inflammation, blocking oxidation of lipoproteins, as well as plaque stabilization (Sanossian et al., 2006).

Low-Density Lipoprotein (LDL): a lipoprotein that builds up slowly in the arteries as plaque (AHA, 2011).

Total Cholesterol (TC): composed of both LDL and HDL lipoproteins (Sullivan, 2001).

Triglycerides (TG): fats in the blood stream that can also contribute to plaque if there are high levels circulating in the blood (AHA, 2011).

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CHAPTER ONE

Introduction

Purpose and Significance

Cardiovascular disease (CVD) is the number one killer of U.S. adults; there are approximately 616,067 deaths each year (Xu, Kochanek, Murphy, & Tejada-Verda, 2010). The biggest risk factors for CVD are hypertension, high cholesterol, Type-2 diabetes, and lifestyle factors, including smoking, nutrition, and physical activity. A good indicator of risk for CVD is cholesterol (AHA, 2011). Cholesterol consists of four components: total cholesterol (TC), high-density lipoproteins (HDL), low-density lipoprotein (LDL), and triglycerides (TRG). All four have been identified as potential predictors of CVD risk (Cromwell, 2007; Natarajan et al., 2003).

Detection of high levels in these components can prompt lifestyle changes that can help prevent or manage CVD (Mayo Clinic, 2011). This is especially needed in rural communities where the risk of dying of CVD is 1.34 times more likely than their non-rural counterparts (Zuniga, Anderson, & Alexander, 2003). However, rural communities have reduced access to primary care and/or screening facilities in which to check their cholesterol. Additionally, rural residents have reduced access to treatment or medication if a diagnosis of CVD is reached (Goins, Williams, Courter, Spencer, & Solovienva, 2005; Strickland & Strickland, 1996).

Application of health behavior theory is useful for better understanding behavior and is important for understanding why a member of a rural community may or may not participate in a cholesterol screening. The Health Belief Model (HBM) is a theoretical model that has been frequently used to help understand participation in health screenings, particularly for breast cancer and cervical cancer (Champion, 1987; Champion & Skinner, 2008; Guvnec, Akyuz, &Acikel, 2010; Tavafian, Hasani, Aghamolaei, Zare & Gregory, 2009). The HBM has also been used qualitatively to understand rural risk for CVD; however, quantitative measures for most HBM constructs have not been developed to understand cholesterol screening behavior (Hamner & Wilder, 2010; Homko et al., 2008; Tovar, Rayens, Clark & Nguyen, 2010). The purpose of this study was to develop HBM construct scales to better understand the use of cholesterol screenings in rural communities in central Texas, and to subsequently examine relationships among HBM constructs, current cholesterol screening behavior (meeting current cholesterol screening recommendations), and intention to participate in a future cholesterol screening.

Research Questions

Question 1: Are the developed HBM measures valid and reliable?

Question 2: What are the perceived susceptibility and severity of high cholesterol in rural communities in Central Texas?

Question 3: What are the perceived benefits and barriers of participating in cholesterol screenings in rural communities?

Question 4: What is the level of self-efficacy to perform cholesterol screenings in rural communities?

Question 5: Are constructs of the HBM related to current cholesterol screening use?

Question 6: Are HBM constructs associated with intention to engage in future cholesterol screenings?

Question 7: Does insurance status (and other demographic and health variables) influence the relationships examined in research questions 5 and 6?

Study Overview

The parameters of this study consist of members of rural communities in central Texas. Surveys, including measures of HBM constructs, cholesterol screening, health, and socio-demographic factors, were completed by rural residents who were either parents or guardians of students or staff at Holland or Granger Independent School District, members or regular attenders at the Granger Catholic church, participants in the HeartAware Program, or participated in community events (e.g. Bingo). Participants had to complete the survey and be over 18 years of age to be included in this study.

Assumptions

The assumption was made that participants answered the survey completely and honestly. Aside from that assumption, the following assumptions were made in relationship to the proposed research questions:

Assumptions of Question 1: Assumptions were made that wording of the original valid and reliable scales provided a foundation for the development of items within the new scales.

Assumptions of Question 2: It was assumed that the constructs of perceived susceptibility and severity among rural communities would be low.

Assumptions of Question 3: It was assumed that the construct of perceived barriers of cholesterol screening would be high among rural communities and that perceived benefits of cholesterol screening would be low among rural communities.

Assumptions of Question 4: It was assumed that the construct of self-efficacy would be low among rural communities.

Assumptions of Question 5: It was assumed that the various constructs within the HBM would be correlated with current cholesterol screening use.

Assumptions of Question 6: It was assumed that the various constructs within the HBM would be correlated with future cholesterol screening.

Assumptions of Question 7: It was assumed that insurance status would positvely influence the relationship between HBM constructs and cholesterol screening use.

Limitations

There were multiple limitations to this study. The first limitation was that the results of the survey instrument were self-reported. Secondly, there was a lack of generalizability due to the use of a convenience sample. The convenience sample included members of three rural communities in central Texas. Third, this study aimed to use theory to quantitatively understand cholesterol screening behavior, which had not previously been done. Fourth, the survey instrument was developed through the modification of scales unrelated to cholesterol screening. However, this research study determined validity and reliablity of these scale. Fifth, there was a small sample size (n=170) which can influence the relationships seen making it a possible limitation to this study. Lastly, the study was a cross-sectional research study design meaning that a cause-and-effect relationship could not be determined.

Public Health Benefits

Findings from this research have several implications for health educators, physicians, and public health researchers and practitioners. First, the developed scales helped to identify perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy related to cholesterol screening behavior. Researchers can use the results and resulting measures of this study to help identify factors that explain why rural populations, particulary those in central Texas, do not participate in available screening programs. Health educators will be able to use this information to design better programs to educate rural communities on the importance of understanding their cholesterol levels. Second, these results will help physicians understand rural communities better and hopefully allow physicians to better meet the needs of rural communities through addressing the communities biggest barriers. Third, the researcher piloted and reported the validity and reliability of HBM-specific scales that can be used by behavioral researchers in other rural communities or in other populations. Fourth, the researcher gained insight into the role of insurance status on cholesterol screening behaviors and HBM constructs, which could be effectively used in the development of new programs to target populations that are in greater need of screening options.

CHAPTER TWO

Literature Review

Introduction

Coronary Heart Disease (CHD) and stroke account for 18% of total disease burden in affluent countries (Sullivan, 2002). It was estimated that by 2020, CHD will be the leading cause of death worldwide and stroke will be the fourth leading cause of death (Sullivan, 2002). The U.S. currently has an estimated 616,067 deaths related to heart disease each year (CDC, 2007). In rural communities the risk of dying of CVD is 1.34 times more likely than for residents of non-rural communities (Zuniga et al., 2003). Various factors influence the risk for heart disease and stroke including smoking, homocysteine, type II diabetes, high blood pressure, physical inactivity, obesity, and cholesterol levels (Sullivan, 2002).

Cholesterol Levels

Cholesterol levels are seen as an important risk factor for heart disease because cholesterol metabolism plays a very distinct and important role in the pathophysiology of the process that builds plaque in various CVD. It is important to note that cholesterol screenings give an indication of the risk for CVD, not a diagnosis of CVD (Sullivan, 2002). The use of cholesterol to predict CVD, particularly CHD, has been consistently supported as a practical risk factor assessment in the literature. However, the main determinant of CVD risk is contested (Sullivan, 2002). Cholesterol can be broken down into four main components: total cholesterol (TC), high-density lipoproteins (HDL), low-density lipoproteins (LDL), and triglycerides (TGs). All four components are measured when a person's cholesterol levels are measured. However, each component has a distinct role and function within the body. Total cholesterol is a composed of both LDL and HDL lipoproteins (Sullivan, 2002). LDL is a lipoprotein that builds up slowly in the arteries as plaque (AHA, 2011). HDL is a complex lipoprotein whose function is associated with reverse cholesterol transport, blocking inflammation, blocking oxidation of lipoproteins, as well as plaque stabilization (Sanossian, Saver, Kim, Razinia & Ovbiagele, 2006). TGs are fats in the blood stream that can also contribute to plaque if there are high levels circulating in the blood.

When estimating the CVD risk related to cholesterol levels, "the measurement of TC alone cannot adequately reflect inter-individual risk of CVD, but the addition of HDL [and if necessary, fasting TG], provides a clearer assessment of the lipoprotein component of CVD risk" (Sullivan, 2002). Each component has a different level of predictive power, but the risk for CHD is affected by the interaction of the lipoproteins with the arterial wall (Cromwell, 2007). However, other research has demonstrated that the ratios, more than the individual components, may be the bigger risk factors for CHD (Natarajan et al., 2003). These ratios compare the levels of LDLs to the levels of HDLs (LDL/HDL) or levels of HDLs to the levels of total cholesterol (HDL/TC). The argument for using cholesterol screening to determine risk is that, at the population level, abnormal cholesterol levels are related to atherosclerosis and adverse CHD events, which allow for prediction of CVD risk (Cromwell, 2007; Sullivan, 2002).

Importance of Theory

Application of health behavior theory is useful for better understanding behavior and behavior change. Theory has been previously applied to understand mutliple screening behaviors, such as HIV screening (Grispen, Ronda, Dinant, de Vries & van der Weijden, 2011), hepatitis C screening (Lu, Huang, & Chu, 2010), cervical cancer screening (Guvenc et al., 2011; Fernandez et al., 2009; Hogenmiller et al., 2007) and breast cancer screening (Champion, 1984; Parsa, Kandiah, Mohd Nasir, Hejar, & Nor Afiah, 2008; Tavafian et al., 2009). Theory has shown predictive power for understanding screening behaviors which is why it should be used to understand cholesterol screening in rural communities (Champion,1984; Tovaret al., 2010).

Cholesterol Screening

Cholesterol screening behavior is not a commonly researched area of CVD prevention. Two rounds of literature searches were conducted. The first involved searching the literature using Pubmed, EBSCOhost, and ScienceDirect databases for studies directly examining cholesterol screening behavior (search terms: “cholesterol screening”, “theory”, “model”), only two studies were identified. The second literature search was for cholesterol related studies using Pubmed, EBSCOhost, and ScienceDirect databases with the same search terms. The second literature search expanded the first by evaluating results more openly, this time including studies that involved cholesterol screenings in any way. This search identified seven additional studies. The aims of these identified studies included aspects that influenced screening behavior (Deskins et al., 2006; Stimpson & Wilson, 2009), understanding outcomes of cholesterol screening (Ammerman et al., 2003; Gans, Burkholder, Risica, Lasater, 2003; Rodondi, Bovet, Hayoz, & Cornuz, 2008; Spoon, Benedict, & Buonamici, 1997;), treatment adherence behaviors (Anderson, Camacho, Iaconi, Tegeler, & Balkrishnan, 2011; Burke, Dunbar-Jacob, Sereika, & Ewart, 2003; Guibert, Leduc, Fournier, & Tetreault, 1999), or satisfaction related to cholesterol screenings (Bekwelem, VanWormer, Boucher, & Pereira, 2011). The most common theoretical frameworks used in understanding aspects of cholesterol screening have been the theory of planned behavior (TPB, n=1), self-efficacy (n=1), and the HBM (n=3). However, theoretical frameworks have often not been used in trying to understand cholesterol screenings (n=4).

Cholesterol Screening Studies

Through the literature search described above, two studies were identified that described actual cholesterol screening behavior. In one of these studies, Deskins et al. (2006) described research using a theoretical framework, the TPB. In the second study, Stimpson and Wilson (2009) described an atheoretical approach to cholesterol screening research. Each is described below.

Theory of Planned Behavior. TPB was adapted from the theory of reasoned action by Fishbein and Ajzen in 1975 to understand individual motivational factors that influence the likelihood of performing a specific behavior. The constructs of TPB are attitude, social norm, perceived behavioral control, and intention (Montaño & Kasprzyk, 2008).

The state of West Virginia is known for its high risk of CVD, especially within rural communities. A qualitative study implemented by Deskins et al. (2006) used the TPB to understand the barriers to rural residents' participation in cholesterol screenings.

The study conducted semi-structured interviews in rural West Virginia counties. The sample consisted of 14 community leaders, 36 parents and 92 fifth-grade students from six counties. Each interview was approximately 30-45 minutes in length for children and 45-60 minutes for adults. The themes presented in the interviews were broken down by construct, attitude included the concerns about outcomes (n=9 transcripts), lack of knowledge about cholesterol and heart disease (n=9 transcripts), lack of community knowledge (n=11 transcripts) and the fear of needles (n=7 transcripts). The most noted aspect (n=14 transcripts) was the traditional Appalachian cultural beliefs which have a resistance to preventive health and to new peoples or ideas. Children's attitude toward behavior was similar with the fear of needles (n=26 transcripts). The children also showed a fear of the outcomes (n=11 transcripts), a lack of concern about health and cholesterol (n=8 transcripts), and felt an invasion of privacy (n=9 transcripts).

Adult interviews addressed perceived behavioral control of the respondents. The major components mentioned were cost (n=10 transcripts), availability (n=6 transcripts), and time (n=7 transcripts). Subjective norm was addressed through the children's interviews. However, the children did not feel social pressure to participate in preventative services and most of the children's beliefs about participation stemmed from their parents' beliefs or the parents would not allow their children to participate (n=22 transcripts). The most significant limitation of this study was the lack of generalizability due to the distinctness of Appalachian culture. However, TPB did provide a helpful theoretical framework for understanding barriers faced in this population (Deskins et al., 2006).

Atheoretical Research. In April 2009, Stimpson and Wilson published a study looking at the relationship between marital status and cholesterol screenings. They used data from the Medical Expenditure Panel Survey (MEPS) which consists of two years of data that interviewed the public on health service use, health conditions, and behavior (n=36,594). Results of the study revealed that widowed men and women were the most likely to be screened, while single men and women were the least likely to be screened. Of the variables measured, marital status was the strongest predictor of cholesterol screening behavior for women and the second strongest predictor for men. Other significant predictors of cholesterol screening behavior were access to care, health conditions, socioeconomic factors, and health behaviors. Screening also increased with age; people over age 50 reported more screenings than those under age 35 (Stimpson & Wilson, 2009).

Cholesterol Related Studies

Eight studies related to cholesterol screening behaviors and one study related to cardiovascular outcomes were identified in the literature search. However, these studies focused on outcomes of screenings, such as participant satisfaction or treatment adherence behaviors (Ammerman et al., 2003; Anderson et al., 2011; Bekwelem et al., 2011; Burke et al., 2003; Gans et al., 2003; Guibert et al., 1999; Rodondi et al., 2008; Spoon et al., 1997; Tovar et al., 2010). The researchers, in five of the nine studies, used a theoretical framework: self-efficacy (Burke et al., 2003) and HBM (Anderson et al., 2011; Guibert et al., 1999; Spoon et al., 1997; Tovar et al., 2010).

Self-efficacy. Self-efficacy is defined as a person's confidence that they can perform a behavior that produces desired outcomes (Champion & Skinner, 2008). Self-Efficacy was originally developed by Bandura (1977) but has since become a fixture in a variety of theories such as Social Cognitive Theory (SCT), Transtheoretical Model (TTM), HBM, and has also become a construct that is measured independently.

Burke et al. (2003) used self-efficacy to understand adherence behavior. In this study, a self-efficacy scale was developed in order measure cholesterol-lowering diet self-efficacy in people who had been diagnosed with elevated cholesterol at a screening. The study consisted of two parts. The first examined 12-day test-retest reliability ($r=0.86$) and internal consistency ($\alpha=0.93$). The second part of the study used the scale to measure self-efficacy ($n=228$). The results indicated that the mean level of perceived self-efficacy was 78.42 (on a scale of 1-100). The study found the survey to be a good measure of self-efficacy related to cholesterol-lowering diet self-efficacy (Burke et al., 2003).

Health Belief Model. The HBM was established in the 1950s to understand why people were not participating in available programs to detect disease (Champion & Skinner, 2008). HBM has six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.

Spoon et al. (1997) used HBM to develop the "Change of Heart Education Program." Through this program, adult participants ($n=285$) received newsletters containing information regarding heart health, particularly ways to lower cholesterol consumption and strategies to overcome related barriers. HBM construct scales were developed to evaluate program effectiveness over 1-month and 6-month exposures to the newsletters. At the end of the evaluation, the program offered a follow-up screening, of which only 10% of participants partook. Results revealed significant changes in overcoming barriers to adopting low fat diets, dietary habits, and decreases in fat consumption (Spoon et al., 1997).

In Quebec, Canada a study was conducted to understand whether or not participants diagnosed with hypercholesterolemia at mass health screenings in rural areas saw their primary physician after the screening (Guibert et al., 1999). The survey analyzed 1,334 participants between 24-64 years old in 54 worksites and 29 public areas in rural Quebec. Participants were contacted two to six months after being screened for a telephone interview. The interview used HBM constructs of perceived threat (perceived susceptibility and perceived severity), perceived self-efficacy, and cues to action to understand compliance in regards to seeing a physician after being told he or she had elevated cholesterol levels. The results of the study showed that overall compliance rates were about 58%. Compliance rates differed by gender, age, awareness of cholesterol levels prior to being screened, and prior treatment for cholesterolemia. Results also supported self-efficacy as an indicator for compliance and suggested that perceived threat and cues to action may modify compliance behavior (Guibert et al., 1999).

Anderson et al. (2011) also used HBM to motivate compliance to seek healthcare services after community stroke risk screenings. Screenings included major risk factors for stroke: elevated total cholesterol, elevated non-fasting blood glucose, hypertension, Transient Ischemic Attack (TIA) symptoms, and smoking status. Participants who completed the study were randomized into one of two groups, with 227 completing the study (n=126 intervention; n=101 control). The intervention group received a HBM based motivational intervention in the month following the screening, and both groups received a 1-month and 3-month follow-up phone interview. Through the use of the HBM based intervention, the intervention group was 1.85 times more likely to seek healthcare services than the control group, with 69% reporting a visit to a primary care physician as opposed to 52% of the control group (Anderson et al., 2011).

Lastly, a study by Tovar et al. (2010) was used that looked at health beliefs concerning CVD risk, diet, and exercise within diabetic patients. Tovar et al. (2010 developed the Health Beliefs Related to Cardiovascular Disease scale (HBCVD). The scale was developed using current literature as well as the authors' expertise in the diabetes population. The HBCVD consisted of a 25-item scale which had four subscales: susceptibility (n=5), severity (n=5), benefits (n=6), and barriers (n=9). The scale was reviewed by both an expert panel and by a group of 10 diabetic patients. The scale was then pilot tested with 68 patients from outpatient cardiovascular and diabetes clinics. Exploratory factor analysis was conducted and the results showed an overall Cronbach's alpha of 0.76 for the scale and 0.82 for the susceptibility subscale, 0.61 for the severity subscale, 0.93 for the benefits subscale, and 0.70 for the barriers subscale. A larger study was conducted after the pilot test with 178 participants that had diabetes. Confirmatory factor analysis was done of the second phase of data which showed an overall Cronbach's alpha of 0.77 with subscale scores of 0.91 for susceptibility, 0.71 for severity, 0.91 for benefits, and 0.62 for barriers. The main limitations for this study were the convenience sample of both the pilot study and larger study and also the homogeneity of both samples which will limit the HBCVD's generalizability (Tovar et al., 2010).

Atheoretical studies. Use of a theoretical framework was not evident in any of the remaining identified research studies of cholesterol screening. Bekwelem et al. (2011) studied the satisfaction of participants in the Heart of New Ulm (HONU) Project in rural Minnesota. The HONU Project was a screening project to understand the cardiovascular risk factors, including total cholesterol and HDL levels, of rural residents at no cost to the participants. This was a cross-sectional research study design using a self-reported survey to understand participants' satisfaction with the HONU project. The survey was consisted of two stages of data collection (1) seven closed-ended questions with 5-pt answer choices and (2) three qualitative interview questions. Based on the responses to the first seven questions, participants were separated into "satisfied" and "not satisfied" groups for interview. There were 118 participants, of which 90% were satisfied with the program. The results associated with this study indicated that community screening programs, like HONU, were valuable resources to the community and could provide necessary health screenings for rural communities (Bekwelem et al., 2011).

In 2008, a pilot study of the CAROtid plaque screening on Smoking (CAROSS) cessation and control of other CVD risk factors was conducted with 30 regular smokers between 40 and 70 years of age. The first part of the study was to understand the behavior of smoking cessation, while the second part of the study aimed to understand if carotid plaque screening, including LDL cholesterol screenings, would decrease smoking behavior and decrease overall CVD risk. The study consisted of a 2-month observation pre-pilot study, smoking cessation counseling and therapy, detection and education of CVD risk, baseline and 2-month psychological and motivational assessments, and 2-month cessation and atherosclerosis knowledge assessments. The pilot study showed an increase in motivation to change smoking behavior, particularly in the 22 smokers who had notable carotid plaque. The 2-month assessments showed a decrease in smoking rates by 63%, and an increase in knowledge in 96% of participants, thus supporting the effectiveness of carotid plaque screenings in eliciting behavior change among smokers (Rodondi et al., 2008).

Gans et al. (2003) aimed to use cholesterol screening programs to change nutritional habits in white, Hispanic, and Black participants in a New England screening program (n=9,803). Participants were recruited across 144 sites (public, medical, religious, or work sites) and incorporated screenings at baseline, three, and twelve months throughout the program. The program also included the Food Habits Questionnaire (FHQ). Results supported differences between eating habits for those of different ethnicities (Gans et al., 2003).

Another dietary intervention based on elevated cholesterol levels was conducted by Ammerman et al. (2003). Seventeen health departments were randomized into either a special intervention group or a minimal intervention. Participants had their cholesterol screened at the health departments to determine eligibility and then again at three, six, and twelve months. The special intervention consisted of the Food for Heart Program, referral to local nutritionist if lipids were elevated at the 3-month follow-up and a reinforcement program including a phone call and two newsletters. The minimal interventions only included nurses providing counseling for the elevated cholesterol levels. Through the intervention, both groups had statistically significant changes in total cholesterol and LDL. However, there were no differences in the treatment groups for total cholesterol and LDL. Although there were small changes between the groups with triglycerides and HDL, but these were not statistically significant. Statistically significant changes in diet were reported for both interventions (Ammerman et al., 2003).

Although various studies have been conducted to understand outcomes related to cholesterol screenings, including adherence, satisfaction, or dietary interventions, very few studies have been conducted with the aim to understand actual screening behavior in regards to cholesterol. Given the current dearth of research in this area, other screening behaviors using theoretical frameworks were examined to better understand screening behaviors at large.

General Screening Behaviors

Because there was a lack of behavioral research in connection with cholesterol screening behavior, attention was turned to general screening behaviors. A significant amount of behavioral research aimed at understanding screening behavior exists, particularly for HIV screening (Grispen et al., 2011), hepatitis C screening (Lu et al., 2010), and cancer screening behaviors (Costanza et al., 2005; Duffett-Leger, Letourneau & Croll, 2008; DuHamel, Li, Rakowski, Samimi & Jandorf, 2011; Fernandez et al., 2009; Ferrer et al., 2011; Guvenc et al., 2011; Hogenmiller et al., 2007; Mason & White, 2008; Oliver, Grindel, DeCoster, Ford, & Martin, 2011; Parsa et al., 2008; Sieverding, Matterne, & Ciccarello, 2010; Tavafian et al., 2009;Tu et al., 2002; Tung, Lu & Cook, 2010; Wagner, Semmler, Good & Wardel, 2009). A literature search was conducted using Pubmed, EBSCOhost, and ScienceDirect databases for studies directly examining screening behavior (search terms: "screening", "theory", and "model"). A second approach was then completed using the same databases with specific theory names (e.g., "Health Belief Model"). Five predominant theories were identified that had been used to understand cancer screening behavior: precaution adoption process model (PAPM; n=2), TPB (n=3), TTM (n=3), self-efficacy (n=3), and the HBM (n=7).

Precaution Adoption Process Model

PAPM was established in 1992 by Weinstein and Sandman to understand the stages of change involved when a person chooses to begin a health-protective behavior. The model includes seven stages of change: stage 1 unaware of the issue, stage 2 unengaged by the issue, stage 3 undecided about acting, stage 4 decided not to act, stage 5 decided to act, stage 6 acting, and stage 7 maintenance (Weinstein, Sandman, & Blalock, 2008). Two studies identified used PAPM to understand screening behavior for colorectal cancer (CRC).

One study was conducted through UMass Memorial Health Care System (UMMHC) to promote CRC screenings among patients who saw a primary healthcare provider (PCP) within the UMMHC (Costanza et al., 2005). Surveys were sent to eligible patients (n=2,934), and 2,027 were returned. The survey measured CRC screening history, PAPM stage and knowledge as well as the participants' beliefs, attitudes, and knowledge regarding CRC screenings. The results of this study showed that 36% of the participants were in the Action/Maintenance stages (stages 6 and 7), 26% of participants were in the decided to act stage (stage 5), and the other 38% were spread over stages 1-4. The analysis revealed that the main factors that influenced screening between the stages were provider recommendations for screenings and family history of CRC. Overall, this study found that the PAPM was useful to understand attitudinal variables related to CRC screenings. The limitations of this study were the possibility for non-response bias, due to it being mailed survey, self-report of CRC screening behaviors, and the homogenous nature of the sample which may limit generalizability (Costanza et al., 2005).

Another study using PAPM for understanding CRC screening was conducted by Ferrer et al. (2011) to understand stage differences of perceived vulnerability, ambiguity, preventive behavior, fatalistic beliefs, and the relationships of health perceptions by stage. The study used the National Cancer Institute's *Health Information National Trends Survey 2003* (HINTS) to obtain access to a data set of 2,470 individuals over the age of 50. Ferrer et al. used the U.S. Preventive Services Task Force guidelines for CRC screening to stage individuals in the HINTS data. Results suggested that the individuals in the not engaged stage (stage 2) had lower levels or worry and lower perceptions of absolute risk. Those in the unaware stage (stage 1) had the highest levels of fatalism. Ambiguity did not vary significantly across all stages. However, health perceptions did vary significantly across all stages with worry and relative risk being the highest in the decided to act stage (stage 5), as was the correlation between worry and family history. The limitations of this study were the cross-sectional research study design, because it did not allow insight on changing the stage of the behavior, and a lack of examination of the relationship between stages, health perceptions, and socio-demographic factors. This study concluded that due to differences in health perceptions across the different stages, using a stage model like PAPM was effective in understanding screening behavior (Ferrer et al., 2011).

Theory of Planned Behavior

TPB was used in three studies to understand cancer screening behaviors specific to breast cancer (Mason & White, 2008), cervical cancer (Duffett-Leger et al; 2008), and prostate/colorectal cancer (Sieverding et al., 2010).

A study was conducted in Australia (Mason & White, 2008) to understand breast self-examinations as a screening method for breast cancer in female college students under age 50. Two hundred and fifty-three women were surveyed as part of an undergraduate psychology course; 92.5% completed the one-month follow-up survey. The survey used an extended-model of TPB including constructs of intention, attitude, subjective norm, perceived behavioral control, self-identity, group norm, knowledge, past behavior, and self-reported behavior. The researchers concluded that the TPB constructs of attitude, subjective norm, and perceived behavioral control predicted intention while intention and perceived behavioral control predicted breast self-exam behavior. Among the extended constructs, only group norm and past behavior showed any predictive power. The researchers recommended using TPB to understand likelihood of participating in screening behavior, particularly breast self-exams in young women (Mason & White, 2008).

TPB has also been used to understand cervical cancer screening of university women in a Canadian study conducted by Duffett-Leger et al. (2008). This study was a web-based, cross-sectional survey of 904 female students under the age of 25. The study used Armstrong's 77-item Student Pap Test Survey and added three perceived behavioral control questions. The revised scale had face validity based on an expert panel review. The results of this study showed that 72% of female students reported having a Pap smear.

The TPB variables of attitude and subjective norms were high among the students, while knowledge about Human Papillomavirus (HPV) was low. Subjective norm was the biggest predictor of intention in this study, which differs from other literature, and may be due to the age range of the surveyed population. Perceived behavioral control and age of learning about Pap smears were also significant predictors of intention to get a Pap smear. The limitations of this study were the self-reported behavior and cross-sectional research study design. (Duffett-Leger et al., 2008).

Lastly, an extended TPB model was used to understand prostate and CRC screening in men (Sieverding et al., 2010). This study measured TPB constructs and added descriptive norm to increase prediction of intention and actual behavior. This study consisted of two parts: in the first study 2,426 German men were surveyed about their past cancer screening behavior and intention for future screening, and in the second study 1,218 German men were mailed a follow-up questionnaire to see if they actually followed-up with getting a cancer screening. The results from the first study indicated that relationships between TPB variables and intention were significantly higher than the relationships between TPB variables and past behaviors. The results of the second study showed that only 20% of men who were surveyed actually participated in a cancer screening. The TPB variables of attitude, subjective norm, and perceived behavioral control were all predictive of intention; however, the added variable of descriptive norm was not predictive of intention except when subjective norm was low. In conclusion, this study exemplified a need for more research to be conducted using TPB (Sieverding et al., 2010).

Transtheoretical Model

The TTM was developed by Prochaska and DiClemente in 1982 to understand stages of change using different process of change and other principles to facilitate change. TTM consists of stages of change, processes of change, decisional balance, and self-efficacy (Prochaska, Redding, & Evers, 2008). The following three studies use TTM to understand breast cancer, cervical cancer, and colorectal cancer screening behaviors.

Tu et al. (2002) used TTM to study stages of change (referred to in the study as stages of adoption) in breast cancer screenings among Cambodian American women (n=400). These women were asked interview questions related to demographics, screening behavior, intentions, health beliefs, and access to health services. The results of this study showed that 26% of Cambodian American women were in maintenance for clinical breast exam screenings, while 23% were in maintenance for mammography screenings, which was lower than other studies done in the U.S. that show maintenance stages to be 47-50% for most young, white American women. This study did not show any significant associations between health beliefs and stages of change however, seeing a female physician did have a significant association with the maintenance stage. This study recommends further studies to determine whether TTM is an effective framework to understand cancer screening behavior (Tu et al., 2002).

TTM has also been used to understand cervical cancer screening as seen in the study by Tung et al. (2010), which surveyed 222 female employees of a Taiwanese hospital. The survey included demographic questions, the cervical cancer screening stage questionnaire, the Self-Efficacy Scale, and a 12-item barriers subscale. Respondents were categorized into the stages as follows: 17% in precontemplation, 10% in contemplation, 0% in preparation, 3% in action, 53% in maintenance, and 17% in relapse. Demographic variables were significantly related to stages of change including age, where 77% of women over 50 were in maintenance, while only 56% of women between 30-50 years old and no one below age 30 were in the maintenance stage. The study showed that women who were in the action or maintenance stages had higher self-efficacy, while the women in the precontemplation stages faced more barriers and fewer benefits than other women. The limitations of this study may be its generalizability since it was aimed at a particularly culture, however other studies regarding TTM and cervical cancer have been done in other populations that show similar predictive effectiveness. Study results support future use of TTM theories for cervical cancer screening behaviors (Tung et al., 2010).

Lastly, TTM has been used to understand CRC screening behavior. A study by DuHamel et al. (2011) used TTM to understand CRC in African Americans. This study used the constructs of stages of adoption and processes of change, which were consolidated into four factors: commitment, information, beyond, and avoids. Participants were recruited through Mount Sinai Hospital and North General Hospital on the basis of being African American men and women over the age of 50. The participants had to already have a primary care physician as well as a need for CRC screening, which resulted in 158 participants. Interviews were conducted using questions to understand stages of adoption and processes of change. The results of this study showed that processes of change were significantly different across different stages indicating a means to facilitate movement across stages. This study also identified factor validity among the processes of change. The limitation of this study was the homogeneity of the sample which may make it hard to establish generalizability. However, based on this study, using processes of change can be helpful to understand stages of change within TTM and CRC screening behaviors (DuHamel et al., 2011).

Self-Efficacy

The following three studies measured the construct of self-efficacy and examined its ability to predict cancer screening behaviors. Self-efficacy was applied to CRC (Wagner et al., 2009) and Pap smears for cervical cancer (Fernandez et al., 2009; Hogenmiller et al., 2007).

A study was conducted by Wagner et al. (2009) to understand health literacy and self-efficacy among 96 participants ages 50-69. The study was composed of demographic questions, a web-based information-seeking session in which participants received internet information and could access additional information by clicking on different links, a four-item self-efficacy questionnaire, and a modified version of the Test of Functional Health Literacy in Adults (TOFHLA). The results of this study showed that there was no association between health literacy and CRC knowledge; however, self-efficacy had a significant association with health literacy and showed predictive power on accessing information regarding CRC screenings (Wagner et al., 2009).

Another study using self-efficacy validated a self-efficacy scale for Pap smear screenings in sheltered inner-city women (Hogenmiller et al., 2007). Study participants were recruited from one of three inner city shelters based on the criteria of being over 19 years of age and the ability to read and write in English. Over the year of recruitment, 161 participants were surveyed. Each participant attended a study informational session in which the study and its components were explained and informed consent forms were signed. The participants each completed the 20-item self-efficacy scale which had strong internal consistency (Cronbach's alpha of 0.95). Self-efficacy had predictive power for stages of change and Pap smear screening intention. The scale was also noted for its readability and established validity within a vulnerable population (Hogenmiller et al., 2007).

The third study using self-efficacy was conducted by Fernandez et al. (2009) to develop and validate a self-efficacy scale for pap smears among low-income Mexican American women that would be more generalizable to the population than the scale developed by Hogenmiller et al. (2007). The data used to compile questions of Pap smear self-efficacy was derived from two different samples that had been previously collected through a study that determined the effectiveness of breast and cervical cancer screening education for Hispanic women. The original data collection involved a 276-item questionnaire. From the information collected in the original samples, a survey was constructed that used Bandura's scale guidelines. The survey underwent an expert panel review and a pilot study to determine the most appropriate scale items. The final scale, validated through a pilot study (n=678), used eight items to measure self-efficacy (α=0.95). The researchers found that this self-efficacy scale was significantly associated with knowledge, intention, and prior experience (Fernandez et al., 2009).

Health Belief Model

Nine studies were identified that demonstrated the effectiveness of HBM in understanding screening behaviors. Five of the studies focused on using HBM to understand cancer screening behaviors (Champion, 1984; Guvenc, et al, 2011; Oliver et al., 2011; Parsa et al., 2008; Tavafian et al., 2009). Two studies focused on the use of

HBM to understand health care screening utilization in rural communities (Goins et al., 2005; Strickland and Strickland, 1996). One study used HBM to understand glucose and HIV screening behaviors (Grispen et al., 2011) and the other looked at HBM to understand hepatitis C screening (Lu, Huang, & Chu, 2010).

In 1984, Dr. Victoria Champion developed and validated the HBM scale for breast self-examination. The developed survey consisted of 39-items with five subscales: susceptibility, seriousness, benefits, barriers, and health motivation, which were piloted on a convenience sample of 301 women. Construct validity (α=0.62) and reliability (r=0.70) were established for the scale. The development and validation of this scale provided a basis for understanding cancer screening behaviors and contributed to the planning of interventions. The scale was revised by Champion in 1987, 1993, 1997, and 1999. This scale was the most well-known and predominantly used scale for measuring HBM constructs within cancer screening behaviors, it has been translated and used in over seven countries (Champion, 1984; Champion & Skinner, 2008).

HBM has been used to understand prostate cancer screening in men in a study by Oliver et al. (2011). This study aimed to understand HBM constructs and source of influence for prostate cancer screening among rural men. Rural men were conveniently recruited through businesses and churches in a southeastern U.S. state (n=95). The scales used to measure the constructs were adapted from Champion's HBM scales to address prostate cancer screenings; the final scale included 17-items which was piloted with 20 rural men to establish validity (α =0.95). The main findings of this research study were that the strongest source of influence on rural men was healthcare providers, and participants' beliefs about prostate cancer (perceived susceptibility and perceived severity) were predictors for screening behavior. The limitations of this study were its lack of generalizability due to its focus on rural populations and the use of a cross-sectional research study design which limited the researchers' ability to see actual behavior change. Overall, the researchers concluded that HBM constructs, specifically perceived susceptibility and perceived severity, were effective predictors of prostate cancer screening behavior (Oliver et al., 2011).

A modified version of Champion's HBM scale has also been used to understand cervical cancer screening behavior in a study conducted by Guvenc et al. (2011). This study was conducted using 237 Turkish women who received a survey that measured HBM constructs and cervical cancer screening behaviors. The survey had been modified to include language regarding Pap smear tests and cervical cancer. This study had acceptable validity and reliability for all items in the modified scales, except one item related to barriers. A final version of the scale resulted from this study that included 36 items which loaded on five factors (susceptibility, severity, benefits, barriers, and health motivation). The biggest limitation to this scale was its use among one culture of women in Turkey which may make it less generalizable to other cultures or countries (Guvenc et al., 2011).

Champion's HBM scale has been commonly used to understand breast cancer and related screening behaviors. In 2008, the scale was applied to Malaysian women by Parsa et al. (2008). This application of the scale allowed for examination of three types of screening behaviors: self-breast exam, clinical breast exam, and mammography and resulted in a 63-item survey in order to measure benefits, barriers, and confidence for each of the screening behaviors. The survey was disseminated in a cross-sectional research study design and included 425 teachers from different secondary schools within Selangor, Malaysia. The modified scale was determined to be valid and reliable with items having acceptable internal consistency (Cronbach's alpha: 0.77-0.94). In this study, Malaysian women had higher barriers and lower susceptibility to breast cancer than what has been reported in other countries; however, this difference may be due to different cultural and religious beliefs. HBM appeared to be an appropriate framework for understanding breast cancer screening behaviors within Malaysian women in this study (Parsa et al., 2008).

Another example of Champion's HBM scale can be seen in a study with Iranian women conducted by Tavafian et al. (2009). This was a cross-sectional research study design that surveyed 240 Iranian women recruited through eight health centers in Iran. The survey was a modified version of Champion's HBM scale (excluding health motivation) which consisted of 31 items all relating to the use of breast self-exams as a screening behavior for breast cancer. Perceived benefits and self-efficacy were found to be higher among those who performed breast self-exams in Tavafian's study; while those who did not perform breast self-exams had higher perceived barriers. The study also concluded that the participants who had higher self-efficacy were more likely to engage in breast self-exams. (Tavafian et al., 2009).

Aside from cancer screening behaviors, other screening behaviors and access to those screenings have been studied. Goins et al. (2005) conducted research in six rural West Virginia communities to understand utilization of healthcare in rural communities. Thirteen 90-minute focus groups with adults over age 60 were conducted and used four main questions: 1) "Do you believe your health care needs are being met? If no, why not?" 2) "What kind of help do you need to address these problems?" 3) "What are the barriers/ problems that you experience in getting the care you need?" 4) "How do you cope with the high cost of prescription medication?" The major themes that arose from these focus groups were transportation difficulties, limited health care supply, lack of quality healthcare, social isolation, financial constraints, and coping with the cost of prescription medications (Goins et al., 2005).

Strickland and Strickland (1996) conducted a study, similar to Goins et al. (2005), with minority households in the rural south. This study was looking at barriers to preventative health, such as general health screenings or dental screenings. Strickland and Strickland conducted household interviews (n=281), community leader interviews (n=51), and focus group interviews (n=6). The identified reasons for why preventives services were not received were inability to pay, which was possibly attributed to lack of coverage or lack of awareness of agencies that may be able to provide support in this manner; health service availability; accessing the system; and coping with prejudice and discrimination due to being poor. There was also a perception that health services were not needed, which was a large contributor to the populations not taking part in available preventative services (Strickland & Strickland, 1996).

Other screening behaviors that have been studied are self-testing of glucose, cholesterol, and HIV (Grispen et al., 2011). A Netherlands-based study aimed to understand the psychosocial determinants of self-testing using HBM, TPB, and the protection motivation theory. The study was an online cross-sectional research study that aimed to understand self-testing behaviors of three diseases: cholesterol, glucose, and HIV. The initial survey was sent to 12,529 panelists to determine which type of self-test the participant had used. Based on how the participant answered the first questionnaire, they were sent another test specific questionnaire. The questionnaires measured perceived susceptibility, perceived severity, cues to action, perceived benefits, perceived barriers, self-efficacy, subjective norm, anticipated regret, moral obligation, and response efficacy. The questionnaire was completed by 513 self-testers and 600 non-testers, distributed across the three test types. Based on the questionnaires, cholesterol test takers were more impacted by perceived susceptibility, perceived benefits, self-efficacy, and moral obligation. Glucose self-testers were influenced by cues to action, self-efficacy, and perceived benefits. While HIV testers were most affected by perceived susceptibility, cues to action, perceived benefits, self-efficacy, and subjective norm. The researchers supported the use of this theoretical framework to understand the psychosocial determinants of self-testing behaviors in the future (Grispen et al., 2011).

Lastly, another area of screening behavior that has been studied is hepatitis C (Lu, Huang, & Chu, 2010). This study aimed to understand healthcare-seeking behaviors for hepatitis C patients using HBM. The 390 participants were hepatitis C patients who frequented hospital clinics for screenings of their hepatitis C. The biggest HBM predictors were perceived susceptibility and severity to disease, particularly among those who visited the clinic between one and six months. Perceived benefits and barriers did not differ significantly among the participants (Lu, Huang, & Chu, 2010).

Although HBM has been used to understand self-testing behaviors (glucose and HIV) as well as hepatitis C screening behavior, HBM has been more consistently used to understand cancer screening behaviors. Cancer screening behaviors also provide a better basis for this study since cancer screening shows risk whereas HIV screening and hepatitis C screening indicate actual presence of a disease.

While current literature has examined outcomes related with cholesterol screening, quantitative research aimed at understanding cholesterol screening behavior does not exist. Understanding utilization of cholesterol screenings is especially important in rural communities, given increased CVD risk. Due to the effectiveness of HBM to understand cancer screening behaviors, HBM should give insight into other screening behaviors, such as cholesterol screening. Therefore, the purpose of this study was to use the HBM to better understand cholesterol screening behaviors of rural residents in central Texas.

The HBM consists of six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy (Champion & Skinner, 2008). Perceived susceptibility is the likelihood of contracting a certain condition within a specified time frame. Perceived severity is the perceived degree of threat a condition or its consequences present to a person. Perceived benefits are the positive consequences associated with a specific behavior. Perceived barriers are the negative consequences associated with a specific behavior. Cues to action are strategies or concepts that trigger action toward a certain behavior. Self-efficacy is the confidence in one's ability to perform a specific behavior when confronted by challenges to performing the behavior (Champion & Skinner, 2008). There is a case made in the literature for the use of perceived susceptibility, perceived severity, perceived benefits, perceived barriers (Costanza et al., 2005; Duffett-Leger, Letourneau & Croll, 2008; DuHamel et al., 2011; Ferrer et al., 2011; Guvenc, Akyuz & Acikel, 2011; Mason & White, 2008; Oliver et al., 2011; Parsa et al., 2008;Sieverding, Matterne, & Ciccarello, 2010; Tavafian et al., 2009;Tu et al., 2002; Tung, Lu & Cook, 2010), and self-efficacy (Fernandez et al., 2009; Hogenmiller et al., 2007; Wagner et al., 2009) to effectively understand cancer screening behavior. Cues to action was not commonly used in cancer screening studies and, thus, was not included in the current study because of the lack of valid and reliable items related to this construct.

Assessment Battery

While the current literature provides HBM scales for cancer screening behaviors, scales to measure cholesterol screening behavior did not currently exist. Thus, there was a need to develop valid and reliable scales to understand cholesterol screening behavior. A literature review was conducted using Pubmed, EBSCOhost, and ScienceDirect databases to identify current measures of HBM constructs for cholesterol screening. In this search, only one previously established HBM measure was identified, susceptibility, as it pertains to the outcomes of cholesterol build-up and heart disease (Tovar et al, 2010). Validity (α=0.82) and reliability (r=0.43) were reported for this 5-item susceptibility scale (Tovar et al., 2010). Since previous scales have not been established for the remaining HBM constructs (perceived severity, perceived benefits, perceived barriers, and self-efficacy), the literature was reviewed to identify scales currently being used to measure HBM constructs as they relate with other screening behaviors to guide development of HBM scales for cholesterol screening.

HBM has been used to understand screening behaviors for glucose, HIV (Grispen et al., 2011), and hepatitis C (Lu, Huang, & Chu, 2010). The most expansive and well-researched screening behavior found in the literature was cancer screenings, specifically, breast cancer (Champion, 1987; Parsa et al., 2008; Tavafian et al., 2009), prostate cancer

(Oliver et al., 2011), colorectal cancer (Wagner et al, 2009), and cervical cancer (Guvenc et al., 2011; Fernandez et al., 2009; Hogenmiller et al, 2007). Using literature that described the use of HBM to understand cancer screening behaviors, scales were developed for perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy, using guidance from existing scales (see Table 1). The following pre-existing scales were used to develop cholesterol screening behavior HBM construct scales: the HBM scale (Champion, 1984), the HBM scale adapted for use with Iranian women (Tavafian et al., 2009), the HBM scale for Cervical Cancer and Pap Smear test (Guvenc et al., 2011), the HBCVD scale (Tovar et al., 2010), and the Self-Efficacy scale for Pap Smear Screening Participation (Hogenmiller et al., 2007). Other items were generated through previously reported qualitative research with rural communities (Goins et al., 2005; Strickland & Strickland, 1996).

Conclusion

Cardiovascular risk is influenced by a variety of factors, with cholesterol being a significant predictor, particularly of CHD. High rates of CVD risk and mortality are prevalent in the U.S., specifically in rural populations. Risk due to elevated cholesterol levels can be easily measured in a routine cholesterol screening. While some of the literature has aimed to understand the outcomes of cholesterol screening, such as participant satisfaction or adherence to medical advice regarding diet change, there has not been quantitative research conducted to understand actual cholesterol screening behavior.

There was a need to examine and better understand cholesterol screening behavior, as cholesterol is a significant predictor of risk for the development of CVD, specifically

CHD. The current literature is lacking studies of cholesterol screening behavior which is due to the lack of a way to measure the behavior. Therefore, the purpose of this study was two-fold (1) to develop valid and reliable measures and (2) to use the HBM to better understand cholesterol screening behavior. In order to have a fundamental basis for surveying screening behaviors, researchers turned to the body of literature surrounding theoretical frameworks to understand cancer screening behaviors. The literature surrounding breast self-exams and pap smears provided the basis for the development of scales to measure cholesterol screening behavior and HBM constructs. The methodology for the development and validation of this scale are presented in chapter two.

Table 1

Available HBM Construct Measures for Heart Disease and Screening Behaviors

Scale	Behavior	Variables	Scale Description	Validity/ Reliability
		Heart Disease		
Tovar et al. (2010)	Physical Activity & Exercise	Susceptibility Severity Benefits Barriers	25-item HBM scale with four construct subscales: susceptibility (n=5), severity (n=5), benefits (n=5), and barriers (n=10). All items were measured on a 4-point Likert Scale 1=strongly disagree to 4= strongly agree	α = 0.76* SS α =0.82, r=0.432 SVα =0.61, r=0.286 BE α = .93, r=0.396 BA α =0.70 r=0.476
		Other Screening Behaviors		
Champion (1984)	Breast cancer screening	Susceptibility Severity Benefits Barriers Health Motivation	39-item HBM scale with five construct subscales: susceptibility (n=6), severity (n=12), benefits (n=5), barriers (n=8), and health	α =0.62* SS α =0.78, r=0.86 SV α =0.78 r=0.76 BE α =0.61 r=0.47

(continued)

Scale	Behavior	Variables	Scale Description	Validity/ Reliability
			motivation (n=8). All items were measured on a 5-point Likert Scale 1=strongly disagree to 5= strongly agree	BA α =0.76 r=0.83 HMα =0.62 r=0.81
Guvenc et al. (2011)	Cervical cancer and Pap smear screening	Susceptibility Severity Benefits Barriers Health Motivation	36-item HBM scale with five construct subscales: susceptibility (n=6), severity (n=12), benefits (n=5), barriers (n=8), and health motivation (n=8). All items were measured using a 5-point Likert Scale 1=strongly disagree to 5= strongly agree	α =0.86* SS α =0.78 r=0.84 SV α =0.78 r=0.85 BE α =0.86 r=0.87 BA α =0.82 r=0.88 HMα =0.62 r=0.79
Hogenmiller et al. (2007)	Pap Smear Screening	Self-Efficacy	20-item self-efficacy scale. All items were measured on a 5-point Likert scale 1=definitely to 5=definitely not	α = 0.95* r <0.30*
Tavafian et al. (2009)	Breast cancer screening	Susceptibility Severity Benefits Barriers Self-Efficacy	31-item HBM scale with five construct subscales: susceptibility (n=3), severity (n=6), benefits (n=4), barriers (n=8), and self-efficacy (n=10). All items were measured using a 5-point Likert Scale 1=strongly disagree to 5= strongly agree	SS α =0.68 SV α =0.77 BE α =0.78 BA α =0.77 SE α =0.87

Note: α = Cronbach's alpha, HBM=Health Belief Model, *=overall scale, SS=susceptibility, SV=severity, BE=benefits, BA=barriers, SE=self-efficacy, HM=Health Motivation

CHAPTER THREE

Methodology

Introduction

This study was designed to measure and understand factors that influence utilization of cholesterol screenings in rural communities in central Texas using the HBM as a conceptual framework. To understand these factors, a questionnaire was constructed and distributed to 1,125 members of three rural communities in central Texas: Holland, Bartlett, and Granger. The questionnaire consisted of questions pertaining to socio-demographic and health factors, cholesterol screening behavior, and questions to measure HBM constructs including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy.

Purpose

The purpose of this study was to develop HBM construct scales to better understand the use of cholesterol screenings in rural communities in central Texas, and to subsequently examine relationships among HBM constructs, current cholesterol screening behavior, and intention to participate in a future cholesterol screening.

Research Questions

To examine the validity and reliability of the HBM construct scales and to understand the use of cholesterol screening in rural communities in central Texas, the following research questions were examined:

Question 1: Are the developed HBM construct measures valid and reliable?

Question 2: What is the perceived susceptibility and severity of high cholesterol in rural communities in Central Texas?

Question 3: What are the perceived benefits and barriers of participating in cholesterol screenings in rural communities?

Question 4: What is the level of self-efficacy to perform cholesterol screenings in rural communities?

Quesition 5: Are HBM constructs related with current cholesterol screening use?

Question 6: Are HBM constructs related with intention to engage in future cholesterol screenings?

Question 7: Does insurance status (and other demographic and health variables) influence the relationships examined in research questions 5 and 6?

Participants

Sample

A convenience sample of community members over 18 years of age who lived or worked within zip codes for Holland, Granger, or Bartlett, TX were recruited to complete the questionnaire. Questionnaires were disseminated to 1,125 adults through the following community partnerships: the Holland and Granger Independent School Districts (n= 535, 460), the Granger Catholic Church (n=10), the HeartAware Reaching Rural Populations Program (n=15), as well as other community events (e.g. Bingo) (n=105).

The sample population was a convenience sample based on previously established relationships with both communities through the HeartAware Program, where there is only one school district within each community. The researcher contacted all superintendents and gained permission to send surveys home through the school. Bartlett ISD did not return calls or emails, so surveys were not sent home through that ISD. In Holland, the researcher was given permission to send home surveys with all grade levels of the school district and school staff. Within Granger, the researcher was given permission to send home surveys with all grade levels as well as the staff of the school. The Catholic Church in Granger was asked to participate in the distribution of surveys because of a previously established relationship and also due to the high volume of community members that attend the Catholic Church as opposed to one of the other three churches in Granger. Churches were contacted in Holland but no response was received. The HeartAware program was also used to disseminate surveys since it is the only established health program in any of the communities and there was a previously established relationship with the HeartAware program.

Sample Size

The desired sample size to establish validity and reliability of the HBM scales was five times the number of total items (Garson, 2008). Because there were 46 total survey items for all HBM constructs, a minimum of 230 completed surveys were needed to ensure sufficient power to examine validity to address research question 1 (Garson, 2008).

To ensure adequate power and validity in the survey, a power of 0.80 (α=0.05) was desired. Based on perceived variance of 0.05 and 1 degree of freedom, 373 surveys were needed (Murphy & Myors, 2004). To receive 373 completed surveys, response rates of the communities needed to be considered. Previous research conducted by rural health service departments in various states, such as Montana and Pennsylvania, report an average response rates of 42-48% in rural communities when conducting health related research using surveys or questionnaires (Seninger & Bainbridge, 2004; Pennsylvania General Assembly, 2005). The first round of data collection included the dissemination of 800 questionnaires. This number allowed for a 42-48% response rate and accounted for missing data in the Granger, Bartlett, and Holland communities. Of the original 800 surveys disseminated only 115 surveys were returned (response rate of 14.5%). Because the response rate was low, it was decided to do a second round of data collection. In the second round of data collection 325 surveys were disseminated (making the total 1,125). Fifty five more surveys were returned, which made the total number of surveys returned 170 (response rate of 15.1%).

Procedures

Survey Development

To assess the use of cholesterol screenings in participants, a questionnaire was used that consisted of scales and items that measured socio-demographic variables, health variables, HBM constructs, and cholesterol screening behavior (See Table 2 for the distribution of items and Appendix I for the complete survey instrument).

This research was approved by the Institutional Review Board (IRB) at Baylor University (IRB # 288751-1). Survey items were developed through a four step process. The first step consisted of reviewing existing scales for items that could be used to understand HBM constructs in relation to cholesterol screening behavior. The scales identified to have usable items were the HBM scale (Champion, 1984), the HBM scale for Cervical Cancer and Pap Smear test (Guvenc et al., 2011), the HBCVD scale (Tovar et al., 2010), the SES-PSSP (Hogenmiller et al., 2007), qualitative research, and an expert panel as described below. These scales were identified through an extensive literature search (please see chapter 2).

Table 2

Theoretical Frameworks and Behavioral Assessment Scales

Variable	Survey Item	Scales Modifications were based upon	Validity and Reliability
Perceived Susceptibility	1-2	Expert Panel Review	Not Reported
	3-7	Tovar et al. (2010)	α =0.82
Perceived Severity	8	Expert Panel Review	Not Reported
	9-15	Champion (1984)	α =0.78
Perceived Benefits	16, 18-19	Expert Panel Review	Not Reported
	17	Champion (1984)	α =0.21
Perceived Barriers	20-22, 30-31, 33-35	Goins et al (2005); Strickland & Strickland (1996)	Not Reported
	23-27	Champion (1984)	α =0.76
	28-29, 32	Guvenc et al. (2011)	α=0.30-0.46
Self-Efficacy	37-46	Hogenmiller et al. (2007)	α =0.95
Demographic Variables	1-13, 17-19	BRFSS (CDC, 2011)	Not Reported
	19-21	Expert Panel Review	
Current Cholesterol Screening	14	BRFSS (CDC, 2011)	Not Reported
	15	Expert Panel Review	
Future Cholesterol Screening	17	Expert Panel Review	Not Reported

Note: BRFSS= Behavior Risk Factor Surveillance System, CDC= Center for Disease Control, α = Cronbach's alpha.

Once these scales were identified, items that were deemed usable by the author were arranged into a draft of the survey instrument by HBM construct and the wording of items was adjusted to reflect cholesterol screening. The second step consisted of developing survey items from the existing qualitative data that suggest various barriers to accessing healthcare in rural populations.

Once the complete questionnaire was compiled, it was submitted to an expert panel, which consisted of one expert in qualitative research, one expert in behavioral research, one expert in internal medicine and cardiology, and one expert in rural public health, for review. The expert panel reviewed the instrument as a whole to determine whether its scope and sequence were appropriate, as well as wording, appropriateness for the target population, and appropriateness for the construct the item should be measuring.

Once the suggestions from each member of the expert panel were received, the instrument was edited. The editing process involved deleting items, adding new items, and changing the wording of items. After the instrument was edited, it was submitted back to two members of the expert panel for final review of item wording and to establish face validity. The Flesch-Kincaid Readability test was then conducted to determine readability level. The resulting survey had a Flesch-Kincaid reading score of 6.1, which falls within the recommended reading level for the general population, between fifth and seventh grade (DeVellis, 2003). Although the reading level may be high for the intended rural population, a lower reading score was unattainable. The Flesch-Kincaid reading score takes into account various criteria when assessing the reading level of the document, one of those criteria is the number of syllables in words, thus the use of four syllable words raises the reading level of the document. The reading level of the scale was high in part due to the word "cholesterol," which is a four syllable word. The survey uses "cholesterol" in most survey items which contributed to a relatively high Flesch-Kincaid reading score that could not be lowered.

Socio-demographic and Health Variables

The majority of the questions regarding demographic variables were derived from questions included in the 2011 BRFSS (CDC, 2011). The BRFSS is an annual, state-based system of telephone surveys that was developed by the CDC in 1984. The BRFSS includes questions pertaining to health risk behaviors, preventative health practices, and healthcare access primarily related to chronic disease and injury prevalence and prevention. The BRFSS includes data monthly from all 50 states and publishes regional and national data analyses. The BRFSS is a public domain scale. This research study used sixteen variables from the BRFSS (CDC, 2011). The questions included age, gender, self-reported height and weight, race/ethnicity, marital status, education level, employment status, health care insurance status, disease status, cigarette smoking, diabetes status, physical activity status, blood pressure screening, and income.

Other variables, zip code, distance to the nearest town, and mode of transportation to and from medical appointments were developed by the expert panel. Zip codes were used to identify residence in the communities of Holland, Granger, and Bartlett or another surrounding rural community. Two more variables, BMI and disease index, were based on answers to previous questions. BMI was created using participants' height and weight. The disease index was constructed using the results of the disease statuses, in order to understand how many diseases each individual participants had.

Cholesterol Screening Behavior

In order to understand cholesterol screening behavior, three questions were included in the demographic portion of the survey instrument to understand past screening behaviors and intention to participate in cholesterol screening behavior. Two questions were used to understand previous cholesterol behavior, one of which was adapted from the 2011 BRFSS questionnaire (CDC, 2011). The original question was stated as “About how long has it been since you last had your blood cholesterol checked?” with answer choices consisting of “Within the past year, within the past two years, within the past 5 years, 5 or more years ago, and don’t know/not sure.” The question was adapted to “when was the last time you had your blood cholesterol checked?” for clarity and readability purposes, with answer choices being changed to “within the past year, within the past two years, within the past 5 years, 5 or more years ago, never, and don’t know/not sure” to allow for the possibility of a participant never having their cholesterol checked. For the statistical analysis of this item, answer responses were dichotomized into 2 groups. The first group included screenings within the American Heart Association’s (AHA) recommendation for cholesterol of every 5 years, which included answer choices “within the past year, within the past two years, and within the past 5 years” (AHA, 2010). The second group included any respondents reporting screening outside of this recommendation, which would include the answer choices “5 or more years ago, never, and don’t know/not sure.”

A second question used to understand past behavior was developed by the expert panel to understand where cholesterol screening is taking place. The question was phrased as “Where did you get your blood cholesterol checked most recently?” with the answer choices of “doctor’s office, screening program, hospital, or I have not had my cholesterol checked.”

A third question was included by the expert panel to measure intention for future behavior which was phrased as “Do you intend to get your cholesterol checked in the next month?” with answer choices of “yes” or “no”. The phrase “next month” was used instead of “next 30 days” to allow for a general estimation, instead of a finite number of days, when they will next screen their cholesterol. This measure of intention allowed the relationship between HBM constructs and intention to be screened to be examined in this study.

Health Belief Model

Perceived susceptibility. Perceived susceptibility is the likelihood of contracting a certain condition within a specified time frame (Champion & Skinner, 2008). A seven-item scale was constructed to measure perceived susceptibility; five of the items were from the HBCVD scale (Tovar et al., 2010). The HBCVD scale was developed by Tovar et al. to understand beliefs surrounding CVD in type-II diabetes patients. The original Cronbach’s alpha for Tovar’s 5-item susceptibility subscale was 0.82. The five items SS3-SS7 (survey items 3-7) that appeared in the current scale were from Tovar et al.’s susceptibility subscale including the original wording of the items. The remaining two items SS1-SS2 (survey items 1-2) derived through the expert panel review were “I have or will probably develop high cholesterol during my life” and “I worry about having high cholesterol”. These items were added to ascertain whether participants saw themselves as susceptible to high cholesterol, which was not measured by existing items. The validity and reliability of the developed items were evaluated through this research (see research question 1). Participants were asked to rank the seven items using a 5-point Likert scale. The points of the Likert scale were as follows: 1=strongly disagree to 5=strongly agree. Possible perceived susceptibility scores were calculated by averaging the Likert scale responses for all items, in accordance with methods used in Tavafian et al. (2009), thus the scores can range from 1 to 5, with higher scores indicating greater perceived susceptibility. Scores were reported as a mean for each item and the overall scale.

Perceived severity. Perceived severity is the perceived degree of threat a condition or its consequences presents to a person (Champion & Skinner, 2008). An eight-item scale was developed to measure perceived severity, seven items (items 9-15) were items modified from Champion's HBM Scale (Champion, 1984). The HBM Scale was developed by Victoria Lee Champion at Indiana University to understand HBM constructs as they relate to breast self-examinations and breast cancer. The seven severity items used in the current scale were taken from the original twelve item subscale in Champion's HBM Scale which reported a Cronbach's alpha of 0.78 (Champion, 1984). The remaining five items in the original scale did not translate to cholesterol screening behaviors according to members of the expert panel. The terminology of five items SV2-SV3, SV5-SV6, SV8 (survey items 9, 10, 12, 13, 15) from Champion's scale were adjusted to cholesterol screenings and CVD. For example, the Champion's item read "If I had breast cancer, my whole life would change", which was changed to "If I had a heart attack or stroke, my whole life would change." The other two items SV4 and SV7 (survey items 11, 14) from Champion's scale were edited by the expert panel to include statements regarding cholesterol screenings and CVD as well as a more appropriate reading level, increasing understandability for the target population. For example, SV4 (survey item 11) in the original scale read “Breast cancer would endanger my marriage (or a significant relationship)” which the expert panel changed to “If I had a heart attack or stroke, it would be hard on my family.” The expert panel felt that this question better fit the understanding that CVD affected all familial relationships, not just marriages, and the change of wording showed consistency with other items which would be more easily understood for the target population. The remaining item SV1 (survey item 8), which states “If I have high cholesterol, I will be more likely to have a heart attack or stroke,” was derived from the expert panel in order to understand if participants linked high cholesterol levels to the severe outcomes of heart attack or stroke. In accordance with methods used in Tavafian et al. (2009), participants were asked to respond to each of the eight items using a 5-point Likert Scale. The points of the Likert Scale ranged from 1=strongly disagree to 5=strongly agree. Perceived severity scores ranged from 1 to 5, with higher scores relating to higher perceived severity. Perceived severity was reported as a mean for each item and the overall scale.

Perceived benefits. Perceived benefits are the positive consequences associated with a specific behavior (Champion & Skinner, 2008). Perceived benefits were measured using a four-item scale. One item BN2 (survey item 17) within this scale was derived from Champion’s original 5-item benefits subscale in the HBM scale with modifications in the terminology to fit the concept of cholesterol screenings and CVD. The item previously read “I would not be so anxious about breast cancer if I did monthly exams” and was changed to “I would not be so anxious about a heart attack or stroke if I got my cholesterol checked." This was the only item retained from Champion's original subscale after review by the expert panel; whereby the expert panel concluded that the other benefit items did not translate to cholesterol screening behaviors. The remaining three items SV1, SV3, and SV4 (survey items 16, 18, 19) were derived through the expert panel to better grasp benefits that were related to cholesterol screening that were not examined in the cancer screening scales. These items were SV1: "Knowing my cholesterol level can help me stay healthy", SV3: "When I do cholesterol checks, it is good for my health", and SV4: "Regular cholesterol checks lower the risk of having a heart attack or stroke." In accordance with methods used in Tavafian et al. (2009), participants were asked to respond to each of the four items using a 5-point Likert Scale. The points of the Likert Scale ranged from 1=strongly disagree to 5=strongly agree. The average perceived benefits scores ranged from 1 to 5, with higher scores indicating higher perceived benefits. Perceived benefits were reported as a mean for each item and an overall mean score.

Perceived barriers. Perceived barriers are negative consequences associated with a specific behavior (Champion & Skinner, 2008). Perceived barriers were measured with a sixteen-item scale. Five items BA4-BA8 (survey items 23-27) were adapted from the eight-item barrier subscale in the Champion's HBM Scale (1984) which had a Cronbach's alpha of 0.76. Only five items were taken from the original eight-item subscale because the expert panel decided that three of the items were not easily understood or were not applicable to cholesterol screenings and CVD. Of five items that were used, BA4 and BA6 (survey items 23, 25) were modified to depict cholesterol screenings and CVD, such as "It is embarrassing for me to do monthly breast exams" being changed to “It is embarrassing for me to get my cholesterol checked.” The other three items BA5, BA7, and BA8 (survey items 24, 26, 27) were modified for readability and clarity; such as “Self breast exams are time consuming” being modified to read as “Getting my cholesterol checked takes too much time.”

Three items BA9, BA10, and BA13 (survey items 28, 29, 32) were derived from Guvenc et al.’s HBM Scale for Cervical Cancer and Pap Smear Test (2011). The HBM scale for Cervical Cancer and Pap smear test was developed by Guvenc et al. (2011). This scale was adapted from Champion’s HBM scale in order to directly address Cervical Cancer and Pap smear testing. Most of the items are similar to those that exist in the original scale aside from the adaptation to Cervical Cancer and Pap smear test terminology. Of the three items, wording of one item, BA10 (survey item 29), was modified from pap smear to cholesterol screening: “I have other problems more important than having Pap Smear Test in my life” to “I have other problems more important than having my cholesterol checked.” The other two items BA9 and BA13 (survey items 28, 32) were modified to reflect cholesterol screening, and further modifications in wording were made to increase readability and clarity. For example, BA9 (survey item 28) originally read “I neglect or cannot remember to have a Pap Smear test regularly.” This item was modified to read “It is hard to remember to get my cholesterol checked.” The remaining eight items BA1-BA3, BA11-BA12, and BA14-BA16 (survey items 20-22, 30-31, 33-35) were developed based on qualitative research that defined barriers faced by rural community members in the access and utilization of healthcare, the barriers addressed included transportation difficulties, limited health care supply, lack of quality healthcare, social isolation, financial constraints, and lack of trust in healthcare providers (Goins et al., 2005; Strickland & Strickland, 1996). The validity and reliability of this newly developed barriers scale was examined through the proposed research (see research question 1). All items were adapted to fit the terminology associated with cholesterol screenings and CVD. In accordance with methods used in Tavafian et al. (2009), participants were asked to respond to the four items using a 5-point Likert Scale. The points of the Likert Scale ranged from 1=strongly disagree to 5=strongly agree. The average perceived barriers scores ranged from 1 to 5, with higher scores equating to higher perceived barriers. Perceived barriers were reported as a mean for each item and an overall mean score.

Self-Efficacy. Self-efficacy is the confidence in one's ability to perform a specific behavior when confronted by challenges to performing the behavior (Bandura, 1977). Self-efficacy was measured with a ten-item scale derived from the Self-Efficacy Scale for Pap Smear Screening Participation, where wording was modified to reflect cholesterol screenings (SES-PSSP; Hogenmiller et al., 2007). SES-PSSP was developed by Hogenmiller et al. (2007) to understand Pap smear screening self-efficacy in the face of barriers. The SES-PSSP was piloted in 2007 using women in inner-city shelters (Hogenmiller et al., 2007). The original scale had 20-items (Cronbach's alpha=0.95); however, some items were not selected for adaptation in this study because they were not applicable to all members of the population being measured, such as questions related to living in drug treatment centers or heavy alcohol drinking behaviors. All items in the original scale were preceded by the statement "How likely are you to get a Pap smear…", which was modified to "How likely are you to get your cholesterol checked" for the current research purposes. Additional item wording was not changed. Participants were asked to respond to the items using a 5-point Likert Scale as originally developed by Hogenmiller et al. (2007). Response options for the self-efficacy scale differed from the rest of the HBM scales. The points of the Likert Scale were as follows 1=very unlikely, 2= unlikely, 3=neutral, 4=likely, 5=very likely. Average self-efficacy scores ranged from 1 to 5, with higher scores indicating greater self-efficacy. Self-efficacy scores were reported as an overall mean score.

Data Collection

The first round of data collection consisted of questionnaire packets containing a completion checklist, informed consent form, and survey, which was sent home with students of both Holland and Granger schools on December 1, 2011. The potential participants were supplied with an IRB approved informed consent form (see Appendix C), which detailed the process of data collection and participant risk. The consent form also informed the participants that the survey was completely anonymous, that they could withdraw from the study at any point, and their eligibility for the incentive. In Holland, surveys were sent home to parents through children in the elementary school, middle school, the high school, and also to the school staff (n= 535). In Granger, the surveys were sent home to parents through the elementary school students (n=175) and were given to all teachers and staff (n=60) through their mailboxes in the staff lounge. Ten surveys were sent out through the Granger Catholic Church's office to staff and the deacon board members. Fifteen surveys were distributed to participants of the HeartAware program in Granger when they came to participate in the program on December 7, 2011. All participants were asked to return the surveys to the school nurses, church secretary, or representatives of the Heart Aware program by December 9, 2011.

Due to a low response rate, a second round of data collection was conducted at the beginning of January 2012. Granger Independent School District was contacted again to send surveys home with middle school and high school students (n=225). The third school district, Bartlett, did not return phone calls regarding participation. The researchers contacted other community organizations in Holland and Granger, such as Bingo, to find other means of data collection. Researchers attended Bingo on January 19, 2012.

Upon completion of a survey, the name of each participant who completed and returned an informed consent and survey form was entered into a drawing for one of ten prizes. The participants selected in the drawing had a choice of a prize (e.g., a portable DVD player, MP4 player, or video MP3 player) or a check for $100. Survey packets were returned to the school nurses, the church secretary, a research assistant, and the nurse who works for the HeartAware program. When the nurse, secretary, or research assistant received the survey packets, they removed the informed consent form from the survey and stored the consent forms in one envelope and the surveys in a second envelope. When the researcher picked up the surveys the informed consent forms were no longer associated with each survey, preserving anonymity. The surveys and informed consent forms were stored separately in a locked filing cabinet. The drawing was conducted using the information on the informed consent forms which had been previously removed from the survey, by the nurses, church secretary, or research assistant. Once the names were drawn for the prizes, the participants whose names were drawn were contacted using the information on the informed consent form. After the drawing, the consent forms were returned to a locked filing cabinet.

Study Design

This study used a cross-sectional research study design. Each participant was given the survey one time during the period of data collection. There was not a comparison or control group.

Timeline

The literature review and the development of the survey occurred over the months of August and September, 2011. On October 10, 2011 the developed survey instrument was sent to the expert panel for review. Feedback from the expert panel was received on October 13, 2011. Updates to the survey were made and a final version of the survey instrument was established on November 7, 2011. The internal Institutional Review Board (IRB) proposal for the research study was submitted to the Department of HHPR on November 8, 2011. Internal IRB approval was granted on November 14, 2011. Changes were made and the University IRB application was submitted November 18, 2011. On November 21, 2011, the IRB was approved by Baylor University as exempt. On November 22, 2011, the surveys were printed and packets were assembled into envelopes for distribution. On November 30, 2011, the surveys were delivered to the Holland and Granger school districts, the Granger Catholic Church, and the HeartAware program for distribution on December 1, 2011. The first round of data collection was completed on December 9, 2011. The thesis proposal occurred on December 13, 2011. The second round of data collection was conducted January 11-25, 2012. The drawing for incentives occurred at the end of February. The remainder of January and February 2012 was devoted to entering and analyzing data.

Statistical Analysis

Once the questionnaires were returned, data was entered, cleaned, and analyzed using SPSS 19. One hundred percent of the data was checked, by a second research assistant, for data entry error prior to the commencement of analysis. Descriptive statistics, such as means and standard deviations, were used to examine demographic characteristics of the sample and responses to HBM subscales.

Research Question 1

In order to determine the validity and reliability of the HBM measures, Exploratory Factor Analysis (EFA) was conducted for each HBM scale (perceived susceptibility, perceived severity, perceived benefits, and perceived barriers). Cronbach's alpha was also used to examine the internal consistency of the items for each HBM construct scales (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy).

Research Question 2

In order to understand perceived susceptibility and perceived severity of high cholesterol in rural communities in central Texas descriptive statistics were used. Specifically, means and standard deviations of each overall construct score were reported, and frequencies related to each perceived susceptibility and perceived severity item were reported in order to better understand which aspects of perceived susceptibility and perceived severity were most commonly noted among these rural populations.

Research Question 3

In order to understand the perceived benefits and perceived barriers of participating in cholesterol screenings in rural communities descriptive statistics were used. Specifically, means and standard deviations of each overall construct were reported, and frequencies related to each perceived benfit and perceived barrier item were reported in order to examine which perceived benefits and perceived barriers were most commonly faced in these rural communities.

Research Question 4

In order to understand the level of self-efficacy for participating in cholesterol screenings in rural communities descriptive statistics were used. Specifically, means and standard deviations of each overall construct were reported, and frequencies related to each self-efficacy item were reported in order to undestand which aspects of self-efficacy were more commonly faced in these rural communities

Research Question 5

In order to determine if the constructs of the HBM were related with current cholesterol screening utilization, both bivariate and multivariate analyses were conducted. The average score variables for each HBM constructs and meeting current guidelines for cholesterol screening behavior were used to construct a correlation matrix. Pearsons correlation coefficients were calculated for continuous variables and point biserial correlation coefficients for categorical variables. One-way ANOVAs were also conducted to further examine potential differences in HBM constructs for meeting or not meeting current cholesterol screening guidelines. Logistic regression analysis was then conducted using meeting cholesterol screening guidelines as the depedent variable and the HBM constucts (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy) as the independent variables.

Research Question 6

To determine the relationship between HBM constructs and intention to engage in future cholesterol screenings, both bivariate and multivariate analyses were conducted. The average score variables for each HBM constructs and future cholesterol screening were used to construct a correlation matrix. Pearson correlation coefficients were calculated for continuous variables and point biserial correlation coefficients for categorical variables. One-way ANOVAs were also conducted to further examine potential differences in HBM constructs for intention or the lack of intention to engage in cholesterol screeening. Logistic regression analysis was then conducted using future cholesterol screening as the depedent variable and the HBM constucts (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy) as the independent variables.

Research Question 7

Multivariate analyses were used to examine if these relationships were impacted when controlling for insurance coverage and other demographic variables (e.g. age, gender, and ethnicity). Specifically, logistic regression analysis was run, first, using meeting cholesterol screening guidelines as the depedent variable and the HBM constucts (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy) as the independent variables, and insurance status as the covariate. Then logistic regresstion analysis was run using future cholesterol screening as the depedent variable and the HBM constucts (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy) as the independent variables, and insurance status as the covariate (see Table 3 below for list of all statistical analyses).

Table 3

Variable Analysis based on Research Questions

Research Questions	Variables	Analysis
1. Are the developed HBM construct measures valid and reliable?	Perceived Susceptibility Perceived Severity Perceived Benefits Perceived Barriers Self-Efficacy	Exploratory Factor Analysis Cronbach's alpha
2. What is the perceived susceptibility and severity of high cholesterol in rural communities in Central Texas?	Perceived Susceptibility Perceived Severity	Descriptive statistics: means and percentages Frequencies by variable
3. What are the perceived benefits and barriers of participating in cholesterol screenings in rural communities?	Perceived Benefits Perceived Barriers	Descriptive statistics: means and perecentages Frequencies by variable
4. What is the level of self-efficacy need to perfomr cholesterol screenings in rural communities?	Self-Efficacy	Descriptive statistics: means and perecentages Frequencies by variable
5. Are constructs of the HBM related with current cholesterol screening use?	Perceived Susceptibility Perceived Severity Perceived Benefits Perceived Barriers Self-Efficacy Previous cholesterol screening	Pearson correlation coefficients Biserial correlation coefficients Logistic regression analysis
6. Are HBM constructs related with intention to engage in future cholesterol screenings?	Perceived Susceptibility Perceived Severity Perceived Benefits Perceived Barriers Self-Efficacy Future cholesterol screening	Pearson correlation coefficients Biserial correlation coefficients Logistic regression analysis

(continued)

Research Questions	Variables	Analysis
7. Does insurance status influence the relationships examined in research questions 5 and 6?	Perceived Susceptibility Perceived Severity Perceived Benefits Perceived Barriers Self-Efficacy Future cholesterol screening Previous cholesterol screening Insurance Status	Logistic regression analysis

**Note*: HBM=Health Belief Model

CHAPTER FOUR

Results

The purpose of this study was to develop HBM construct scales to better understand the use of cholesterol screenings in rural communities in central Texas, and to subsequently examine relationships among HBM constructs, current cholesterol screening behavior, and intention to participate in a future cholesterol screening. Data was collected in two rounds. The first round of data collection returned 115 surveys by mid-December. Because the quantity of returned surveys was so small, the researchers decided to conduct another round of data collection. The second round of data collection yielded an additional 55 completed surveys, making the total completed 170. Of the 1,125 cholesterol screening behavior surveys distributed, 170 were completed and returned (15.1%). The data was entered into an excel document and 100% of the entered data was verified by a second researcher. Data was then transferred into SPSS 19 and was cleaned and analyzed. New variable measures were created for BMI using the height and weight variables collected in the survey (BMI= [weight (lb.)/height $(in)^2$ x 703]) and other variables were dichotomized in order to conduct analyses of interest (BMI, insurance, race/ethnicity, income, and cholesterol screening).

Demographic Variables

A total of 21 demographic and health variables were asked in the survey. Please see table 4 for demographic characteristics. Participants were predominantly white (75.9%) and female (77.6%), with an average age of 45.3 years (SD=15.26). On average participants had completed the 12th grade or equivalent. Over 65% percent of the participants were married and 55.3% were employed for wages. The average income was below $50,000 (58%) and 81.2% reported living within a rural community.

Please see table 5 for health-related characteristics of the sample. Over 73% of participants reported having some kind of healthcare insurance (including Medicare and Medicaid), and 93.5% reported having their own vehicle that could be used to get to a medical appointment. Over 33% admitted to smoking at least some days during the week. Around 77% reported exercising at least once a week. The average BMI of the sample population was 30.34 (SD=7.62), indicating the average person is considered obese (BMI ≥ 30.0). Disease statuses related to CVD were asked as a part of the demographic variables of the survey, the main conditions reported were high blood pressure (30%), high cholesterol (25.9%), and diabetes (14.7%). Disease was also reported as an index for how many diseases were identified by each participant, 45.4% reported having at least one of the listed diseases, and the average number of diseases for the sample was 0.76 (SD=0.98). Screening for blood pressure, blood sugar, and cholesterol were also reported (see table 5 below). A variable was created to further dichotomize cholesterol screenings into those who met the AHA's recommendation for being screened at least once in the last five years (74.6%) and those who did not (25.4%).

Table 4

Demographic Characteristics of the Sample (N=170)

Sample Characteristics		N	%
Age	20-29	20	11.8%
(N=166)	30-39	52	30.8%
	40-49	37	21.8%
	50-59	28	16.5%
	60-69	12	7.2%
	70-79	11	6.6%
	80-89	6	3.6%
Gender	Male	35	20.6%
(N=167)	Female	132	77.6%
Race/Ethnicity	White	129	75.9%
(N=167)	African American	10	5.9%
	Hispanic	25	14.7%
	Asian/Pacific Islander	3	1.8%
Marital Status	Married	111	65.3%
(N=166)	Divorced	15	8.8%
	Widowed	14	8.2%
	Separated	9	5.3%
	Never Married (single)	11	6.6%
	Member of an unmarried couple	6	3.5%
Level of	Grades 1-8	6	3.5%
Education	Grades 9-11	18	10.6%
(N=167)	Grade 12 or GED	57	33.5%
	College 1-3 years	46	27.1%
	College 4 years or more	40	23.5%
Employment	Employed for wages	94	55.3%
(N=161)	Self-employed	7	4.1%
	Out of work >1 year	17	10.5%
	Homemaker	24	14.1%
	Student	4	2.4%
	Retired	15	8.8%
Living	Rural	138	81.2%
	Urban	29	17.1%
Distance from	Live in town	73	42.9%
town	1-5 miles out of town	31	18.2%
(N=168)	5-10 miles out of town	28	16.5%
	More than 10 miles out of town	36	21.2%
Income	Less than $19,999	39	22.9%
(N=160)	$20,000 to $39,999	40	23.6%
	$40,000 to $59,999	28	16.5%
	$60,000 to $79,999	20	11.8%
	$80,000 or greater	32	18.9%
Transportation	Own vehicle	159	93.5%
(N=167)	Family member's vehicle	5	2.9%
	Friend's vehicle	3	1.8%

* %=percent of the sample, N=sample size, cell N values differ because of missing data

Table 5

Health Status Characteristics of the Sample

Sample Characteristics		N	Total
Insurance	Yes	125	73.5%
(N=165)	No	39	23.0%
BMI	≤ 25	38	22.4%
(N=155)	25-29.99	46	27.1%
	≥30	71	41.7%
Disease Status	Diabetes	25	14.7%
(N=170)	Heart Attack	4	2.4%
	Angina	10	5.9%
	High Blood Pressure	51	30.0%
	Bypass or Stent	2	1.2%
	Congestive Heart Failure	1	0.6%
	High Cholesterol	44	25.9%
	Stroke or TIA	4	2.4%
Disease Index	0 diseases	93	54.7%
(N=170)	1 disease	37	21.8%
	2 diseases	27	15.9%
	3 diseases	9	5.3%
	4+ diseases	4	2.4%
Smoking	Everyday	35	20.6%
(N=167)	Some days	22	12.9%
	Not at all	110	64.7%
Tested for high Blood Sugar	Yes	103	60.6%
(N=169)	No	57	38.2%
Exercise	Don't exercise	25	14.7%
(N=167)	Once a month	11	6.5%
	Once a week	35	20.6%
	3-5 times a week	41	24.1%
	Once a day	55	32.4%
Tested Cholesterol	Within the past year	90	52.9%
(N=169)	Within past 2 years	28	16.5%
	Within past 5 years	8	4.7%
	>5 years ago	4	2.4%
	Never	39	22.9%
Intention to check Cholesterol in next	Yes	53	31.2%
month	No	112	65.9%
(N=165)			
Tested Blood Pressure	Within past year	153	90.0%
(N=169)	Within past 2 years	3	1.8%
	Within past 5 years	3	1.8%
	>5 years ago	2	1.2%
	Never	8	4.7%

* %=percent of the sample, N=sample size, cell N values differ because of missing data

Research Questions

To examine the validity and reliability of the HBM construct scales and to understand the use of cholesterol screening in rural communities in central Texas, the following research questions were examined:

Question 1: Are the developed HBM measures valid and reliable?

Question 2: What are the perceived susceptibility and severity of high cholesterol in rural communities in Central Texas?

Question 3: What are the perceived benefits and barriers of participating in cholesterol screenings in rural communities?

Question 4: What is the level of self-efficacy to perform cholesterol screenings in rural communities?

Question 5: Are constructs of the HBM related to current cholesterol screening use?

Question 6: Are HBM constructs associated with intention to engage in future cholesterol screenings?

Question 7: Does insurance status (and other demographic and health variables) influence the relationships examined in research questions 5 and 6?

Research Question 1

1. Are the developed HBM measures valid and reliable?

Exploratory Factor Analysis (EFA) was conducted in order to answer research question 1. Items were examined for logical model fit using the following guidelines: eigenvalues ≥1.0 and scree plots for the factor(s), a communality >0.45 (Stevens, 2002), and simple structure loading on at least one factor ≥ 0.40 to be retained and no cross-loadings ≥ 3.2 for two or more factors (Tabachnick & Fidell, 2001).

If an item had communality ≤0.45, it was further reviewed and in the case of multiple items having communalities ≤0.45, the item with the lowest communality ≤0.45 was removed (Stevens, 2002). After ensuring communalities >0.45, all items with cross-loadings were examined and removed one at a time. This decision was based on examining all factors with cross-loadings and retaining the factor(s) that demonstrated the highest single loading on one of the factors for which it cross-loaded. Items were examined and removed one at a time to ensure logical model fit. At least three items were retained for every factor (or scale if it only had one factor), even if the cross-loading was a slightly above 3.2 (Costello & Osbourne, 2005).

Perceived Susceptibility

Perceived susceptibility was measured using seven items; five of the items were from the HBCVD scale (Tovar et al., 2010) and two items were derived by an expert panel. The perceived susceptibility scale started with seven items (SS1-SS7). EFA was conducted using the cutoff points of an eigenvalue >1 to be considered a factor, a communality >0.45, and simple structure with a factor loading of >0.40 on one factor and not cross-loading ≥ 3.2 on two or more factors. If these constraints were not met, each item was examined individually and items were removed one at a time to ensure appropriate removal.

An eigenvalue of 4.67 and a scree plot revealed one factor. All items had communalities of >0.45 (range: 0.57-0.78), all factors loaded on only one factor and each loaded above 0.40 (range: 0.75-0.88). Therefore, there was no modification of the susceptibility scale. The final perceived susceptibility scale was a one factor scale with seven items and a Cronbach's alpha of 0.92. The factor accounted for 66.65% of the variance. The items, characteristics, and factor loadings can be seen in Table 6.

Table 6

Perceived Susceptibly Items and Exploratory Factor Analysis Characteristics

Cholesterol Survey Definitions and Items	M (SD)	α	Eigenvalue	Factor Loading
Overall Scale	2.90 (0.96)	0.915	4.666	
SS1: I have or will probably develop high cholesterol during my life.				0.766
SS2: I worry about having high cholesterol.				0.753
SS3: It is likely that I will suffer from a heart attack or stroke in the future.				0.859
SS4: My chances of suffering from a heart attack or stroke in the next few years are great.				0.881
SS5: I feel I will have a heart attack or stroke sometime during my life.				0.807
SS6: Having a heart attack or stroke is currently a possibility for me.				0.833
SS7: I am concerned about the chance of having a heart attack or stroke in the near future.				0.808

*SS=susceptibility, M=mean, SD=standard deviation, α= Cronbach's alpha

Perceived Severity

Perceived severity was measured using eight items, seven items of which were modified using items from the HBM scale (Champion, 1984) and one item derived by the expert panel. The perceived severity scale started with eight items (SV1-SV8, see table 7 for item wording). EFA was conducted using eigenvalues >1 to be considered a factor, a communality >0.45, and simple structure with a factor loading of >0.40 on one factor and not cross-loading ≥ 3.2 on two or more factors. If these constraints were not met, each item was examined individually and items were removed one at a time to ensure appropriate removal.

Table 7

Original Perceived Severity Scale Items

Item Wording
SV1: If I have high cholesterol, I will be more likely to have a heart attack or stroke.
SV2: If I had a heart attack and stroke, my whole life would change.
SV3: Having a heart attack or stroke will cause problems that would last a long time.
SV4: If I had a heart attack or stroke it would be hard on my family.
SV5: The thought of having a heart attack or stroke scares me.
SV6: If I had a heart attack or stroke I might not be able to work.
SV7: If I had a heart attack or stroke I might not be able to provide for myself or my family.
SV8: My feelings about myself would change if I had a heart attack or stroke.

*SV=severity

The original EFA eigenvalues and scree plot suggested two factors. The eigenvalues of the factors were Factor 1 = 4.28 and Factor 2 = 1.05. The communalities revealed item SV5 to have a communality ≤0.45. Thus, item SV5 was removed due to its low communality (0.45). In the second modification, the eigenvalue and scree plot indicated two factors with eigenvalues of Factor 1 =3.88 and Factor 2 =1.05. All items showed communalities >0.45. However, three items (SV2, SV3, SV4) cross-loaded on both factors. SV3 was removed due cross-loading with moderate loadings on both factors (0.59, 0.61). Moderate loading was defined as the factor loaded > 3.2 on both or more factors, but when the other factor loadings were assessed, this factor had the lowest factor loadings in comparison to the other factors that had cross-loadings. Thus, the factor retained, demonstrated the highest single factor loading in comparison to the others with cross-loadings.

In the third modification, the eigenvalues and scree plot still supported two factors with eigenvalues of Factor 1 = 3.24 and Factor 2 = 1.03. All communalities were >0.45. Two items (SV2 and SV4) loaded on both factors resulting in SV2 being removed for having moderate loading on two factors (0.52, 0.65). In the fourth modification, the eigenvalues and scree plot only supported one factor with an eigenvalue of 2.71. This modification resulted in two items (SV1 and SV4) having communalities <0.45. SV1 was then removed due to having the lowest communality (0.17).

In the fifth modification the eigenvalue and scree plot again revealed one factor with an eigenvalue of 2.59. This modification revealed SV4 to have a communality of 0.41, thus it was removed. The eigenvalues and scree plot of the sixth modification supported one factor with an eigenvalue of 2.29. All communalities were >0.45 (range of 0.67-0.83). All items (SV6-SV8) loaded on the factor >0.40 (range of 0.82-0.91). The final perceived severity scale was a one factor scale with three items and a Cronbach's alpha of 0.84. The factor accounted for 76.37% of the variance. The items, characteristics, and factor loadings are reported in Table 8.

Table 8

Final Perceived Severity Items and Exploratory Factor Analysis Characteristics

Cholesterol Survey Definitions and Items	M (SD)	α	Eigenvalue	Factor Loading
Overall Scale	4.15 (0.69)	0.843	2.291	
SV6: If I had a heart attack or stroke I might not be able to work.				0.910
SV7: If I had a heart attack or stroke I wouldn't be able to provide for my family.				0.894
SV8: My feelings about myself would change if I had a heart attack or stroke.				0.816

*SV=severity, M=mean, SD=standard deviation, α= Cronbach's alpha

Perceived Benefits

Perceived benefits were measured using four items. One item, BN2 (survey item 17), within this scale was derived from Champion's original 5-item benefits subscale in the HBM scale and the three other items were derived through the expert panel. The perceived benefits scale started with four items (BN1-BN4). EFA was conducted using the cutoff points of an eigenvalue >1 to be considered a factor, a communality >0.45, and simple structure with a factor loading of >0.40 on one factor and no cross-loadings ≥ 3.2 on two or more factors. If these constraints were not met, each item was examined individually, and items were removed one at a time to ensure appropriate removal. The original eigenvalues and scree plot revealed only one factor with an eigenvalue of 2.68. All items had communalities >0.45 (range 0.60-0.73), and all items loaded on the single factor >0.32 (range 0.78-0.85). Therefore, no modifications were made to the perceived benefits scale. The resulting perceived benefits scale was a one factor scale with four items and a Cronbach's alpha of 0.83. The factor accounted for 67.07% of the variance. The items, characteristics, and factor loading are reported for this scale in Table 9.

Table 9

Perceived Benefits Items and Exploratory Factor Analysis Characteristics

Cholesterol Survey Definitions and Items	M (SD)	α	Eigenvalue	Factor Loading
Overall Scale	3.94 (0.79)	0.831	2.683	
BN1: Knowing my cholesterol level can help me stay healthy.				0.688
BN2: I would not be so anxious about a heart attack or stroke if I got my cholesterol checked.				0.601
BN3: When I do cholesterol checks, it is good for my health.				0.726
BN4: Regular cholesterol checks lower the risk of having a heart attack or stroke.				0.667

*BN=Benefits, M=mean, SD=standard deviation, α= Cronbach's alpha

Perceived Barriers

Perceived barriers were measured with sixteen items. Five items were adapted from the eight-item barrier subscale in the Champion's HBM Scale (1984), three items were derived from Guvenc et al.'s HBM scale for Cervical Cancer and Pap Smear Test (2011), and the remaining eight items were developed based on qualitative research. The perceived barriers EFA started with 16 items (BA1-BA16, see Table 10 for original items). EFA was conducted using the cutoff points of an eigenvalue >1 to be considered a factor, a communality >0.45, and simple structure with a factor loading of >0.40 on one factor and no cross-loadings ≥ 3.2 on two or more factors. If these constraints were not met, each item was examined individually and items were removed one at a time to ensure appropriate removal.

Table 10

Original Perceived Barrier Items

Item Wording
BA1: I don't think it's useful to know my cholesterol level.
BA2: Knowing my cholesterol level doesn't keep me from having a heart attack or stroke.
BA3: It is not easy for me to get my cholesterol checked.
BA4: It is embarrassing for me to get my cholesterol checked.
BA5: Cholesterol checks can be painful or uncomfortable.
BA6: My family would make fun of me if I got my cholesterol checked.
BA7: Getting cholesterol checks gets in the way of things I need to do.
BA8: Getting my cholesterol checked takes too much time.
BA9: It is hard to remember to get my cholesterol checked.
BA10: I have other problems more important than checking my cholesterol.
BA11: I am able to do everything I want to, so I don't need to get my cholesterol checked.
BA12: I do not have transportation to get my cholesterol checked.
BA13: There is nowhere to get my cholesterol checked where I live.
BA14: I can't afford to get my cholesterol checked.
BA15: I do not get my cholesterol checked because I do not trust healthcare providers.
BA16: I do not get my cholesterol checked because I can't understand or talk with my doctor.

*BA=barriers

A total of eleven modifications were conducted on the barriers scale. In the first modification, eigenvalues and the scree plot revealed four factors: Factor 1=7.27, Factor 2= 1.51, Factor 3=1.21 and Factor 4= 1.00. Item BA2 had a communality of 0.25, which resulted in its removal. In the second modification, eigenvalues and the scree plot revealed three factors: Factor 1=7.25, Factor 2= 1.39, and Factor 3= 1.18. All communalities were >0.45. Five items (BA1, BA4, BA6, BA13, BA14) cross-loaded on at least two factors. BA13 was removed due to having moderate cross-loading on two factors (0.58, 0.44). In the third modification the eigenvalues and scree plot revealed three factors: Factor 1= 6.90, Factor 2= 1.39, Factor 3= 1.15. All communalities were >0.45 and three items (BA1, BA6, BA14) cross-loaded on at least two factors. BA14 was removed due to having moderate cross-loading on two factors (0.41, 0.69).

In the fourth modification, eigenvalues and the scree plot supported two factors: Factor 1=6.63 and Factor 2= 1.38. Items BA1 and BA3 had communalities <0.45, which was the basis for removing item BA3 with the lowest communality (0.25). The fifth modification eigenvalues and scree plot revealed two factors: Factor 1= 6.45 and Factor 2= 1.36. BA1 also had a low communality of 0.29, thus it was removed.

The sixth modification eigenvalues and scree plot supported two factors: Factor 1= 6.22 and Factor 2= 1.35. All communalities were >0.45. Two items (BA5, BA6) cross-loaded on both factors, and BA5 was removed due to moderate cross-loading on both factors (0.57, 0.43). The seventh modification eigenvalues and scree plot suggested two factors: Factor 1= 5.75 and Factor 2= 1.35. All communalities were >0.45 and five items (BA4, BA6, BA7, BA8, BA11) cross-loaded on both factors. BA11 was removed because it had moderate cross-loading on two factors (0.36, 0.70).

In the eighth modification, eigenvalues and the scree plot suggested two factors: Factor 1= 5.24 and Factor 2= 1.31. All communalities were >0.45 and four items (BA4, BA6, BA7, BA8) cross-loaded on both factors. BA6 was removed because it had moderate cross-loading on both factors (0.71, 0.39). The ninth modification eigenvalues and scree plot revealed two factors: Factor 1= 4.67 and Factor 2= 1.28. All communalities were >0.45 and two items (BA4 and BA8) cross-loaded on both factors. BA4 was removed because it had moderate cross-loading on both factors (0.38, 0.72).

The tenth modification also suggested two factors (Factor 1= 4.13 and Factor 2= 1.16) using the eigenvalues and scree plot. All communalities were >0.45 and one item (BA8) cross-loaded on both factors, thus it was removed (0.83, 0.33). The final model revealed two factors (Factor 1 = 3.49 and Factor 2 = 1.16) through eigenvalues and a scree plot. All communalities were >0.45 (range: 0.65-0.87). Factor 1 included items BA12, BA15, and BA16 (loading range: 0.74-0.87) and Factor 2 included items BA7, BA9, and BA10 (loading range: 0.81-0.90). The final perceived barriers scale was a two factor scale, Factor 1: access to healthcare providers and Factor 2: inconveniences, with six items, three-items within each factor, and an overall Cronbach's alpha of 0.843. Combined, the two factors accounted for 77.45% of the variance. The factors, items, characteristics, and factor loadings are reported for this scale in Table 11.

Table 11

Final Perceived Barriers Items and Exploratory Factor Analysis Characteristics

Cholesterol Survey Definitions and Items	M (SD)	α	Eigenvalue	Factor Loading
Overall Barrier Scale	1.912 (0.68)	0.843		
Factor 1- Access to health care providers (3 items)	1.55 (0.70)	0.876	3.489	
BA12: I do not have transportation to get to the doctor to get my cholesterol checked.				0.808
BA 15: I do not get my cholesterol checked because I do not trust healthcare providers.				0.899
BA 16: I do not get my cholesterol checked because I can't understand or talk with my doctor.				0.884
Factor 2- Inconvenience (3 items)	2.17 (0.99)	0.826	1.158	
BA7: Getting cholesterol checks gets in the way of things I need to do.				0.743
BA9: It is hard to remember to get my cholesterol checked.				0.874
BA 10: I have other problems more important than checking my cholesterol.				0.867

*BA=barriers, M=mean, SD=standard deviation, α= Cronbach's alpha

Self-Efficacy

Self-efficacy was measured with a ten-item scale derived from the SES-PSSP (Hogenmiller et al., 2007). The self-efficacy scale started with 10 items (SE1-SE10, see Table 12 for original items). EFA was conducted using the cutoff points of an eigenvalue >1 to be considered a factor, a communality >0.45, and simple structure with a factor loading of >0.40 on one factor and no cross-loadings ≥ 3.2 on two or more factors. If these constraints were not met, each item was examined individually and items were removed one at a time to ensure appropriate removal.

Table 12

Original Self-Efficacy Items

Item Wording
SE1: If you had to pay for it?
SE2: If you don't have a doctor?
SE 3: If it is hard to get a doctor to take your insurance?
SE4: If you would lose work time?
SE5: If a close friend or family member tells you a screening is needed?
SE6: If you need a ride to your appointment?
SE7: If your friend tells you a screening is unnecessary?
SE8: If your last screening was normal?
SE9: If your last screening was abnormal?
SE10: If you are too busy during clinic hours?

*SE=self-efficacy

Five modifications were made through the conducting the EFA. In the first EFA, eigenvalues and the scree plot suggested two factors: Factor 1=4.89 and Factor 2= 1.31. All communalities were >0.45 and four items (SE3, SE4, SE6, SE7) cross-loaded on both factors. SE4 was removed because it had moderate cross-loading on both factors (0.61, 0.55). The second modification eigenvalues and a scree plot supported two factors: Factor 1= 4.22 and Factor 2= 1.34. All communalities were >0.45 and three items (SE3, SE6, SE10) cross-loaded on two factors. SE6 was removed because it had moderate cross-loading on two factors (0.66, 0.44). The third modification eigenvalues and scree plot revealed two factors: Factor 1=3.66 and Factor 2=1.34. All communalities were >0.45 and two items (SE3, SE10) cross-loaded on both factors. SE 10 was removed because it had moderate cross-loading on both factors (0.70, 0.43).

In the fourth modification, eigenvalues and a scree plot revealed two factors: Factor 1= 3.07 and Factor 2= 1.33. All communalities were >0.45. Only one item (SE8) cross-loaded on both factors and it was removed (0.67, 0.33). This final modification eigenvalues and scree plot supported two factors: Factor 1= 2.68 and Factor 2= 1.29. All communalities were >0.45 (ranging 0.56-0.75). Factor 1, personal costs, included items SE1, SE2, SE3 (factor loading range of 0.71-0.86) and Factor 2, relationships, SE5, SE7, and SE9 (factor loading range of 0.73-0.81). The resulting self-efficacy scale was a two factor scale with six items, three within each factor, and an overall Cronbach's alpha of 0.75. Combined, the two factors accounted for 66.15% of the variance. The factors, items, characteristics, and loadings are reported for this scale in Table 13.

Table 13

Final Self-Efficacy Items and Exploratory Factor Analysis Characteristics

Cholesterol Survey Definitions and Items	M (SD)	α	Eigenvalue	Factor Loading
Overall Self-Efficacy Scale	3.01 (0.83)	0.747		
Factor 1- Personal Costs (3 items)	2.58 (1.1)	0.766	2.680	
SE1: If you have to pay for it?				0.856
SE2: If you don't have a doctor?				0.852
SE3: If it is hard to get a doctor to take your insurance?				0.705
Factor 2- Relationships (3 items)	3.39 (0.96)	0.699	1.289	
SE5: If a close family member tells you it's needed?				0.729
SE7: If your friend tells you a screening is unnecessary?				0.784
SE9: If your last screening was abnormal?				0.804

*SE=self-efficacy, M=mean, SD=standard deviation, α= Cronbach's alpha

Research Question 2

2. What are the perceived susceptibility and severity of high cholesterol in rural communities in central Texas?

In order to answer research question 2, descriptive statistics, specifically means and frequencies, were conducted. The answer choices for both perceived susceptibility and perceived severity were "agree", "disagree", and "neutral" for the purposes of reporting frequencies. The category of disagree included Likert scale answer choices "1 strongly disagree" and "2 disagree." The category of agree included answer choices "4 agree" and "5 strongly agree." The category of neutral only included answer choice "3 neutral." Scores for perceived susceptibility items ranged from 1 to 5 with a mean of 2.89 (SD=0.96), indicating that the sample on average reported being neutral. The perceived susceptibility scale had seven items, all of which remained after EFA. The most frequently reported susceptibility item was SS1:"I have or will probably develop high cholesterol during my life" (51.8%), followed by SS2:"I worry about having high cholesterol" (44.1%). The least reported susceptibility item was SS4: "My chances of suffering from a heart attack or stroke in the next few years are great" (19.4%). The full list of perceived susceptibility items and frequencies are reported in Figure 1.

Scores for severity items ranged from 1 to 5 with a mean of 4.15 (SD=0.69), indicating that the sample on average reported to agree with the perceived severity items. The perceived severity scale had eight original items, however only three items remained in the scale after EFA. The most frequently reported severity item was SV2: "If I had a heart attack or stroke it would be hard on my family" (94.7%), however this item was removed during EFA.

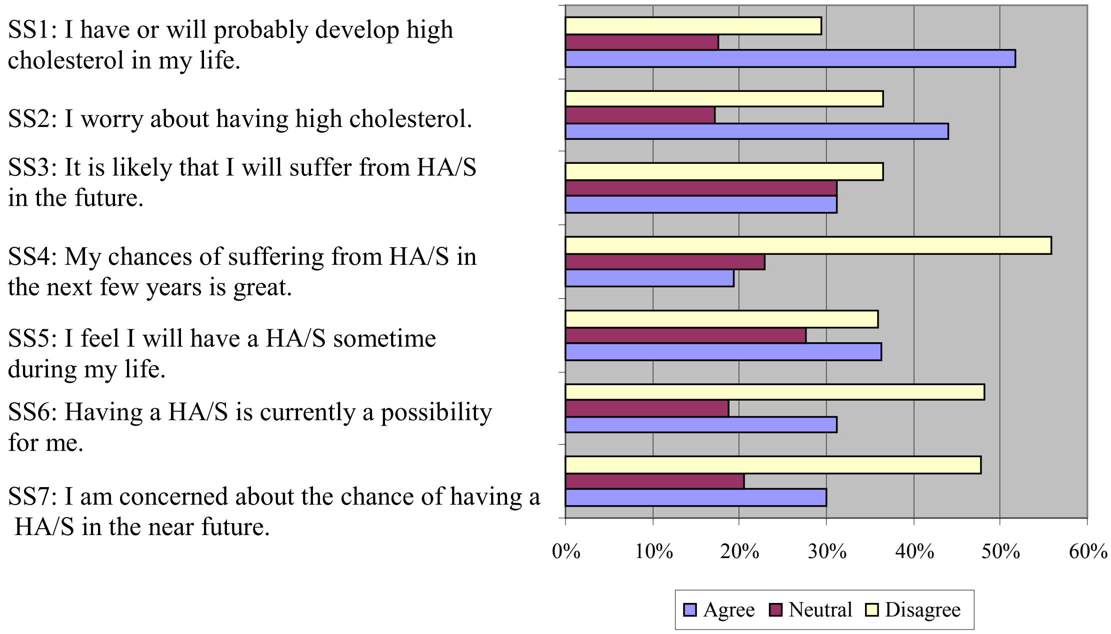

Figure 1: Original Perceived Susceptibility Items and Frequencies

The three items that remained in the scale were SV6: "If I had a heart attack or stroke I might not be able to work" (81.1%), SV7: "If I had a heart attack or stroke I wouldn't be able to provide for myself or my family" (73%), and SV8: "My feelings about myself would change if I had a heart attack or stroke" (70%). The full list of original perceived severity items and frequencies are reported in Figure 2 below.

Research Question 3

3. What are the perceived benefits and barriers of participating in the cholesterol screenings in rural communities?

In order to answer research question 3, descriptive statistics, specifically means and frequencies, were conducted. The answer choices for both perceived benefits and perceived barriers were grouped into "agree", "disagree", and neutral for the purposes of reporting frequencies.

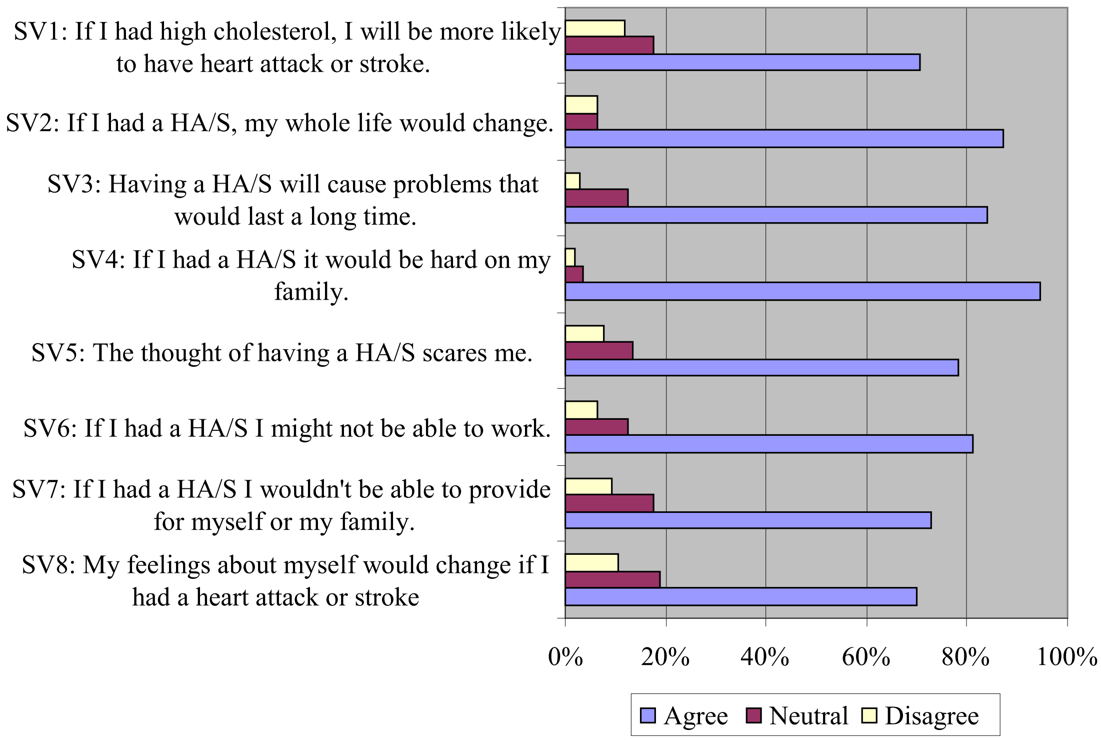

Figure 2: Original Perceived Severity Items and Frequencies

The category of disagree included Likert scale answer choices "1 strongly disagree" and "2 disagree." The category of agree included answer choices "4 agree" and "5 strongly agree." The category of neutral included the answer choice "3 neutral." Scores for perceived benefits items ranged from 1 to 5 with a mean of 3.94 (SD=0.79), indicating the sample on average to agree with the perceived benefits items. The perceived benefits scale had four items, all of which remained after the EFA. The most reported benefit to cholesterol screening was BN1: "Knowing my cholesterol can help me stay healthy" (87.6%), while the least reported benefit was BN2: "I wouldn't be anxious if I knew my cholesterol" (53%). The full list of items and frequencies for perceived benefits are reported in Figure 3.

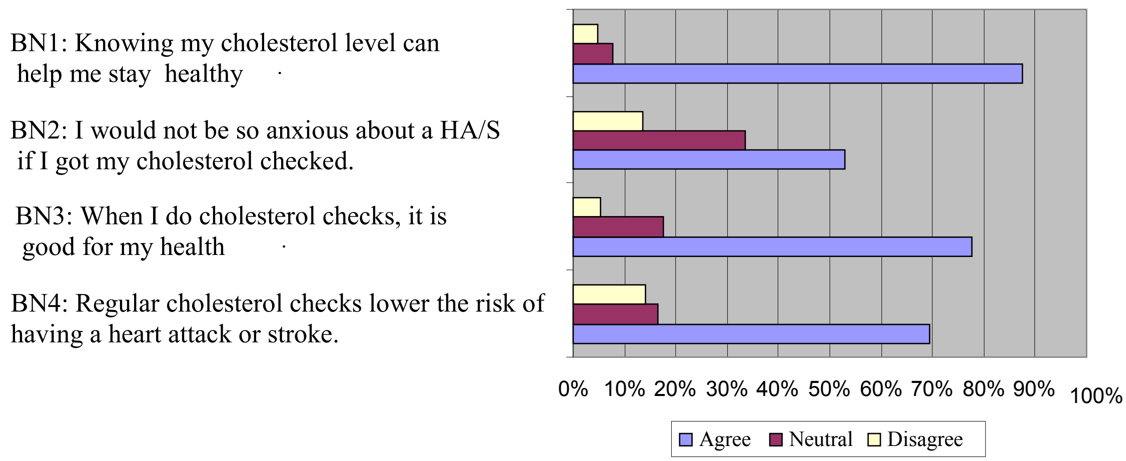

Figure 3: Original Benefit Items and Frequencies

Scores for perceived barriers ranged from 1 to 5 with a mean of 1.92 (SD=0.68), indicating the average of the sample reported to disagree with the perceived barrier items. The perceived barriers scale originally had 16 items, however only six items remained after EFA. The most commonly reported barriers were BA1: "Knowing my cholesterol level doesn't keep me from having a heart attack or stroke" (59.4%) and BA9: "It is hard to remember to get my cholesterol checked" (24.7%). The latter remained in the scale along with BA10: "I have other problems more important than checking my cholesterol" (17%), BA7: "Getting my cholesterol checked gets in the way of things I need to do" (9.4%), BA12: "I do not have transportation to get to the doctor to get my cholesterol checked" (2.4%), BA15: "I do not get my cholesterol checked because I do not trust healthcare providers" (1.8%), and BA16: "I do not get my cholesterol checked because I can't understand or talk with my doctor" (3.6%). The full list of original perceived barriers items and frequencies are reported in Figure 4 and 5.

Research Question 4

4. What was the level of self-efficacy to perform cholesterol screenings in rural communities?

In order to answer research question 4, descriptive statistics, specifically means and frequencies, were recorded. The answer choices for self-efficacy were categorized into likely, unlikely, and neutral for the purposes of reporting frequencies. The category of "unlikely" included Likert scale answer choices "1 very unlikely" and "2 unlikely." The category of "likely" included answer choices "4 likely" and "5 very likely." The category of neutral only included the answer choice "3 neutral." Scores for self-efficacy items ranged from 1 to 5 with a mean of 3.01 (SD=0.83), indicating the average of the sample reported being neutral. The items that were the least likely were SE3: "if it is hard to get a doctor to take your insurance" (61.7%) and SE2: "if you don't have a doctor" (53.5%). Both of the aforementioned items were retained within the scale along with SE1: "if you have to pay for it" (39.4%), SE5: "if a close family member tells you it's needed" (15.8%), SE7: "if your friend tells you a screening is unnecessary" (39.4%), and SE9: "if your last screening was abnormal" (16.5%). Original self-efficacy items and frequencies are reported in Figure 6.

Research Question 5

5. Are HBM constructs related to current cholesterol screening utilization?

In order answer research question 5, both bivariate and multivariate analyses were conducted.

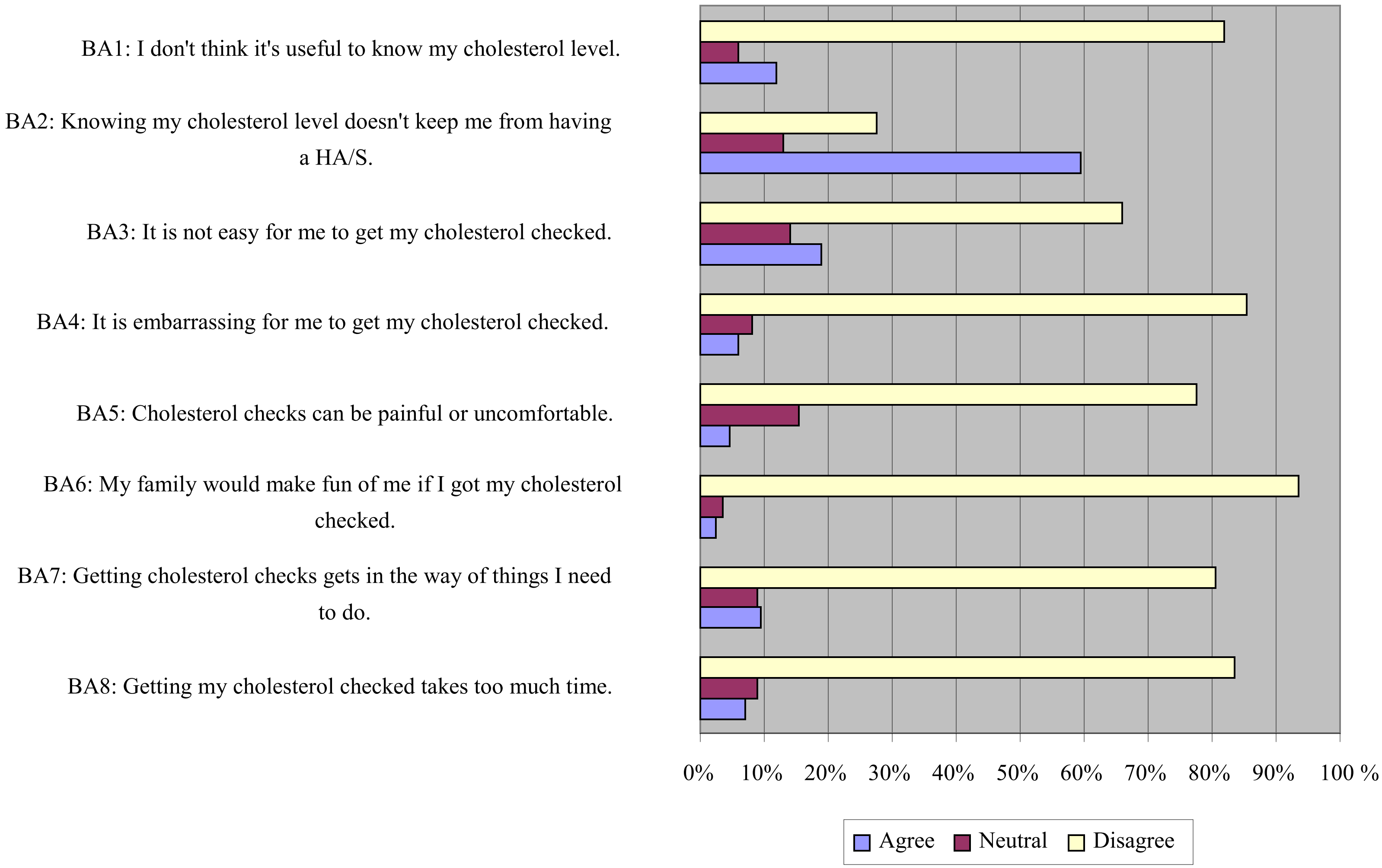

Figure 4: Original Perceived Barrier Items and Frequencies (Items 1-8)

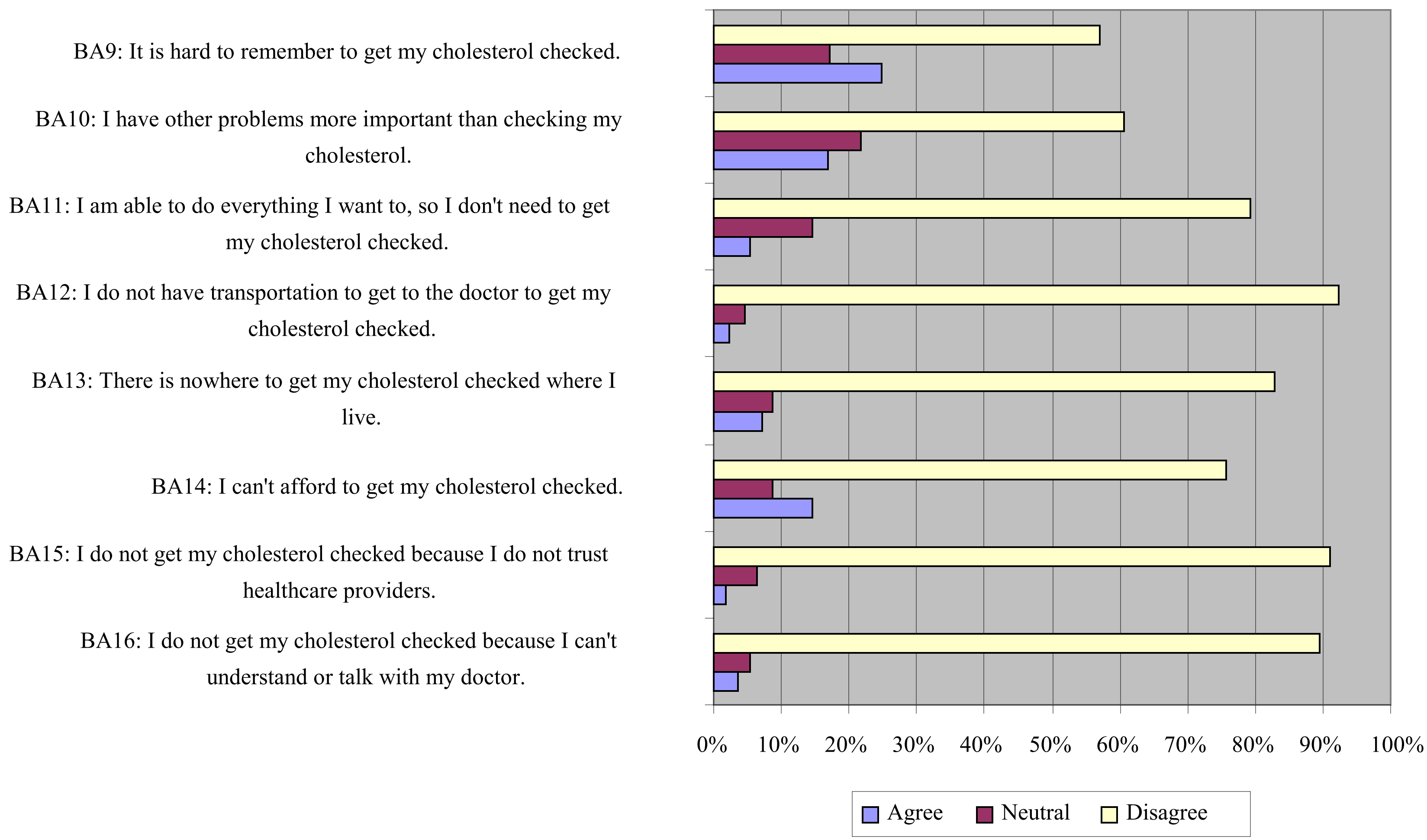

Figure 5: Original Perceived Barrier Items and Frequencies (Items 9-16)

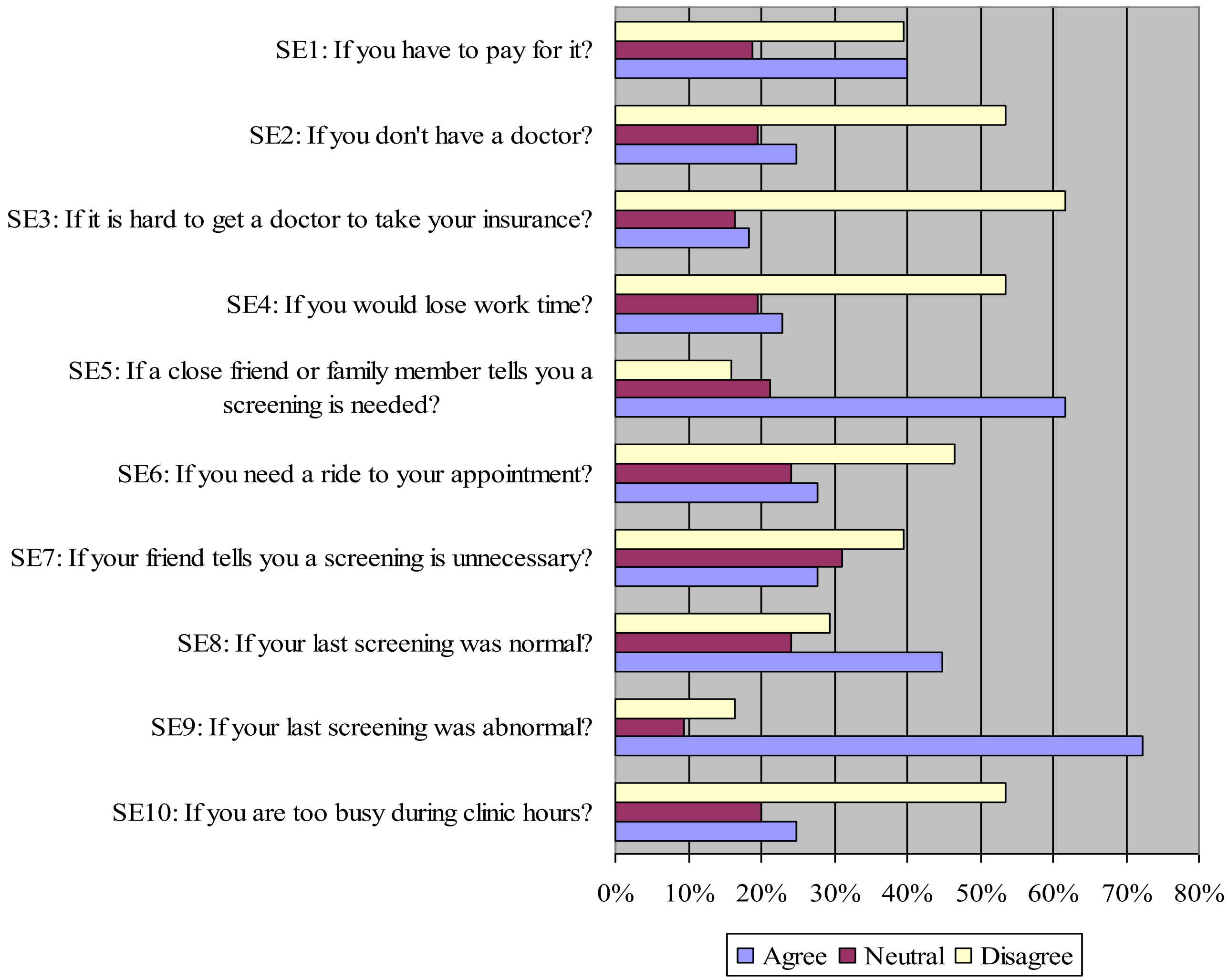

Figure 6: Original Self-Efficacy Items and Frequencies

The average score variables for each HBM construct and meeting cholesterol screening recommendations (answer options dichotomized into 0=not meeing recommendations for cholesterol screening which included answer choices " more than 5 years", "never," and "don't know/not sure" and 1=meeting guidelines for cholesterol screening behavior including answer choices "within the past year," "within the past two years," and "within the past five years") were used to construct a correlation matrix. Pearsons correlation coefficients were calculated for continuous variables and point biserial correlation coefficients for categorical variables (see Table14). Analysis revelaed a significant positive correlation between current cholesterol behavior and perceived susceptibility ($r=0.24$; $p<0.01$), meaning that the higher a person's perceived susceptibility the more likely he/she had checked his/her cholesterol in the previous five years. A negative relationship between periceived barriers and current cholesterol behavior ($r=-0.17$; $p<0.05$) was also observed, meaning that the greater barriers perceived by a person, the less likely it was that he/she had checked his/her cholesterol. The relationships between current cholesterol screening and severity, benefits, and self-efficacy were not statistically significant ($p>.05$).

One-way ANOVAs were conducted to examine differences in HBM constructs by current cholesterol screening behavior (screening within the past 5 years or not). ANOVAs indicated that susceptibility and barriers were significiantly associated with current cholesterol screening behavior. However, severity, benefits, and self-efficacy were not. For this sample, those who had been screened within the last year ($M=3.11$, $SD=0.97$) had significantly higher susceptibility scores ($F=9.75$; $p=0.002$) than those who did not have a screening within the last year ($M=2.66$, $SD=0.90$). In regards to barriers, those who did not have a screening within the last year (M=2.04, SD=0.59) had significantly more perceived barriers (F=4.75; p=0.031) than those who did have a screening within the last year (M=1.82, SD=0.74).

Table 14

Pearsons and Point Biserial Correlations for Current Cholesterol Behavior

	Cholesterol checked	Avg SS	Avg SV	Avg BN	Avg BA	Avg SE
Cholesterol Checked	-					
Avg SS	0.22** *(n=169)*	-				
Avg SV	-0.07 *(n=169)*	0.27** *(n=170)*	-			
Avg BN	0.12 *(n=169)*	0.21** *(n=170)*	0.50** *(n=170)*	-		
Avg BA	-0.18* *(n=168)*	0.08 *(n=169)*	0.01 *(n=169)*	-0.20** *(n=169)*	-	
Avg SE	0.10 *(n=167)*	0.15 *(n=168)*	-0.04 *(n=168)*	0.20** *(n=168)*	-0.01 *(n=168)*	-

* Correlation is significant at the 0.05 level
**Correlation is significant at the 0.01 level
***Note: *n*=sample size, Cell *n* values differ due to missing data, Avg=mean, SS=perceived susceptibility, SV=perceived severity, BN=perceived benfits, BA=perceived barriers, SE=self-efficacy.

Logistic regression analysis was conducted using current cholesterol screening behavior as the depedent variable and the HBM constucts of perceived susceptibility and perceived barriers as the independent variables, due to the established significant bivariate relationships with current cholesterol screening behavior for each. The other HBM constructs were not included as they were not significantly related with current cholesterol screening in bivariate analyses. The resulting model was significant (χ^2 = 16.340; p = 0.000). Backward Stepwise Regression indicated that both perceived susceptibility (p<0.01) and perceived barriers (p<0.01) were significantly related with current cholesterol screening behavior in this multivariate model. Specifically, perceived suceptibility was positively related with meeting current guidelines for cholesterol screening and perceived barriers were negatively related with meeting those same guidelines, while controlling for the other HBM construct respectively (see Table 15). For every one unit increase in perceived susceptibility score, the odds of meeting the current guidelines for cholesterol screening increased by 1.974 [CI (95%) = 1.296, 3.008], while accounting for perceived barriers. However, for every one unit increase in perceived barriers score, the odds of meeting the current guidelines for cholesterol screening decreased by 0.458 [CI (95%) = 0.260, 0.806], while controlling for perceived susceptibility.

Table 15

Logistic Regression Model Examining the Relationship Between HBM Constructs and Current Cholesterol Screening Behavior

	β	S.E.	Wald	df	*p*-value	Exp(B)	95% C.I. (lower, upper)	
BA	-0.780	0.288	7.328	1	0.007	0.458	0.260	0.806
SS	0.680	0.215	10.018	1	0.002	1.974	1.296	3.008

**Note:* n=170; β=standardized beta weight, S.E.=standard error, Wald=wald statistic, df=degrees of freedom, Exp(B)=odds ratio, C.I.=confidence interval, HBM=Health Belief Model, BA=perceived barriers, SS=perceived susceptibility.

Research Question 6

6. Are HBM constructs associated with intention to engage in cholesterol screenings in the next month?

In order to answer research question 6, both bivariate and multivariate analyses were conducted. The average score variables for each HBM constructs and future cholesterol screening intention were used to construct a correlation matrix. Pearson correlation coefficients were calculated for continuous variables and point biserial correlation coefficients for categorical variables (See Table 16). Analyses revealed a positive correlation between perceived susceptibility and intention to check cholesterol within the next month (r=0.31; p=0.00) and a positive correlation between perceived benefits and intention to check cholesterol in the next month (r=0.15; p=0.51). Analyses also revealed a positive relationship between perceived barriers and intention that was approaching significance (r=-0.14; p=0.07), which was considered in further analysis. There were no statistically significant relationships between intention and perceived severity or self-efficacy.

Table 16

Pearsons and Point Biserial Correlations for Intention

	Intention	Avg SS	Avg SV	Avg BN	Avg BA	Avg SE
Intention	-					
Avg SS	0.31** *(n=165)*	-				
Avg SV	0.01 *(n=165)*	0.27** *(n=170)*	-			
Avg BN	0.15* *(n=165)*	0.21** *(n=170)*	0.50** *(n=170)*	-		
Avg BA	-0.14 *(n=165)*	0.08 *(n=169)*	0.01 *(n=169)*	-0.20** *(n=169)*	-	
Avg SE	0.10 *(n=164)*	0.15 *(n=168)*	-0.04 *(n=168)*	0.202** *(n=168)*	-0.01 *(n=168)*	-

* Correlation is significant at the 0.05 level
**Correlation is significant at the 0.01 level
***Note: *n*=sample size, cell *N* values differ due to missing data, Avg = mean. Intention=intention to have cholesterol checked in the next month, SS=perceived susceptibility, SV=perceived severity, BN=perceived benfits, BA=perceived barriers, SE=self-efficacy

One-way ANOVAs were conducted to examine differences in HBM constructs by intention to have your cholesterol checked in the next month. Perceived susceptibility (p=0.00) and perceived benefits (p=0.05) were significiantly associated with intention, and perceived barriers (p=0.07) approached significance. However, perceived severity and self-efficacy were not related with intention. For this sample, those who intended to be screened in the next month (M=3.34, SD=0.99) had significantly higher perceived susceptibility scores (F=17.42; p=0.00) than those who did not have an intetion to get screened in the next month (M=2.71, SD=0.87). In addition, those who intended to be screened in the next month (M=4.12, SD=0.77) reported greater perceived benefits (F=3.87; p=0.05) than those who did not have an intention to be screened in the next month (M=3.87, SD=0.75). In regards to barriers, those who did not have an intention to be screened in the next month (M=1.99, SD=0.63) reported significantly greater barriers (F=3.31; p=0.07) than those who intended to be screened in the next month (M=1.78, SD=0.78).

Logistic regression was conducted using intention to screen cholesterol as the depedent variable and the HBM constucts of perceived susceptibility, perceived benefits, and perceived barriers as the independent variables given the established significant bivariate relationships of each with intention. Due to the strength of the relationship between perceived barriers (r=-0.14 p<0.71) and intention, although not significant at the $\alpha \leq .05$ level, perceived barriers were also included in logistic regression analyses. Perceived severity and self-efficacy were not included as they were not significantly related with intention in bivariate analyses. The resulting model was signifant (χ^2 = 21.33; p = 0.00). Backward stepwise regression indicated that both perceived susceptibility (p<0.01) and perceived barriers (p<0.05) were significantly related with intention to have cholesterol checked in the next month. Specifically, perceived susceptibility was postively related to intention and perceived barriers were negatively associtaed with intention (see Table 17). The table below explains that for every one unit increase in perceived susceptibility score, the odds of intending to get cholesterol screened in the next month increased by 2.22 [CI (95%) = 1.50, 3.29]. It also shows that for every one unit increase in the perceived barriers score, the odds of intending to get cholesterol screened in the next month decreased by 0.57 [CI (95%) = 0.34, 0.95].

Table 17

Logistic Regression Model Examining the Relationship Between HBM Constructs and Intention

	β	S.E.	Wald	df	*p* value	Exp(B)	95% C.I. (lower, upper)	
BA	-0.560	0.261	4.603	1	0.032	0.571	0.342	0.953
SS	0.798	0.201	15.729	1	0.000	2.220	1.497	3.293

Note: *n*=170; β=standardized beta weight, S.E.=standard error, Wald=wald statistic, df=degrees of freedom, C.I.=confidence interval, HBM=Health Belief Model, BA=perceived barriers, SS=perceived susceptibility.

Research Question 7

7. Does insurance status (and other demographic and health variables) influence the relationships examined in research questions 5 and 6?

In order to answer research question 7, pearson correlation coefficients were calculated for continuous demographic variables and point biserial correlation coefficients for categorical demographic variables, including insurance status. Current cholesterol screening behavior was significantly related with insurance status, disease index, BMI, and age (see Table 18). Intention to screen in the next month was significantly related with BMI, ethnicity, income, education, and age, but not insurance status (see Table 19).

Logistic regression analyses were used to examine whether relationships between HBM constructs and cholesterol screening behavior (current or future intention) were impacted when controlling for insurance status and other significantly related demographic variables identified in bivariate analyses (e.g., age, race/ethnicity, disease index, BMI, income, and education). For current cholesterol screening behavior insurance coverage was examined as a potential correlate. However, since insurance status was not related with intention to screen in the next month in bivariate analyses, it was not included in the logistic regression analysis for intention. Two logistic regression models were conducted for each dependent variable. First, all HBM constructs significantly related with the dependent variable of interest in previous multivariate analyses and all demographic and health variables significantly related in bivariate analyses were entered into a logistic regression model. Subsequently, a backwards stepwise logistic regression model was conducted to further examine significance and the best fitting model.

The first logistic regression model examining current cholesterol screening (meeting AHA recommendations) was conducted by entering all significant demographic and health variables related with meeting guidelines in bivariate analyses in addition to the HBM constructs of perceived susceptibility and perceived barriers. This model was significant ($\chi^2 = 50.16$, $p = 0.00$), where the only significant variables were perceived barriers, insurance, age, disease index, and BMI. Specifically, perceived barriers were negatively related with meeting current cholesterol screening guidelines, while insurance status (having insurance), older age, a higher disease index (more diseases), and higher BMI were all positively related with meeting current guidelines for cholesterol screening (see Table 20).

Table 18

Pearsons and Point Biserial Correlations for Demographic Variables and Current Screening Behavior

	CG	DZ	BMI	R/E	INS	INC	EDU	GEN	AGE	ZC
DZ	0.28** *(n=169)*	-								
BMI	0.16* *(n=154)*	0.19* *(n=155)*	-							
R/E	0.79 *(n=166)*	0.37* *(n=167)*	0.11 *(n=155)*	-						
INS	0.40** *(n=163)*	0.05 *(n=164)*	-0.02 *(n=153)*	0.03 *(n=164)*	-					
INC	0.12 *(n=160)*	-0.21** *(n=159)*	-0.24** *(n=147)*	-0.32** *(n=156)*	0.27** *(n=154)*	-				
EDU	-0.7 *(n=166)*	-0.35** *(n=167)*	-0.14 *(n=155)*	-0.42** *(n=167)*	0.25** *(n=164)*	0.57** *(n=157)*	-			
GEN	-0.14 *(n=166)*	-0.01 *(n=167)*	-0.04 *(n=155)*	0.07 *(n=167)*	-0.01 *(n=157)*	-0.14 *(n=157)*	0.04 *(n=167)*	-		
AGE	0.29** *(n=165)*	-0.39** *(n=166)*	0.17* *(n=164)*	0.17* *(n=166)*	0.17* *(n=164)*	-0.14 *(n=156)*	-.31** *(n=166)*	-0.13 *(n=166)*	-	
ZC	0.09 *(n=167)*	0.17* *(n=167)*	-0.04 *(n=152)*	0.16* *(n=167)*	-0.01 *(n=162)*	-0.14 *(n=158)*	-0.03 *(n=164)*	0.15 *(n=164)*	-0.13 *(n=166)*	-

*Correlation is significant at the 0.05 level
** Correlation is signifciant at the 0.01 level
***CG=cholesterol guidelines, DZ=disease index, BMI=body mass index, R/E=race/ethnicity (0=white, 1=non-white), INS=insurance (0=not insured, 1=insured), INC=income, EDU=education, GEN=gender (1=males, 2=females), ZC=zipcode (1=rural, 2=urban)

Table 19

Pearsons and Point Biserial Correlations for Demographic Variables and Intention to Screen

	INT	DZ	BMI	R/E	INS	INC	EDU	GEN	AGE	ZC
CG	0.17* *(n=165)*									
DZ	0.36** *(n=169)*	-								
BMI	0.20* *(n=152)*	0.19* *(n=155)*	-							
R/E	0.45** *(n=152)*	0.37* *(n=167)*	0.11 *(n=155)*	-						
INS	0.02 *(n=160)*	0.05 *(n=164)*	-0.02 *(n=153)*	0.03 *(n=164)*	-					
INC	-0.38** *(n=156)*	-0.22** *(n=159)*	-0.28** *(n=146)*	-0.32** *(n=156)*	0.26** *(n=153)*	-				
EDU	-0.32** *(n=162)*	-0.35** *(n=167)*	-0.14 *(n=155)*	-0.42** *(n=167)*	0.25** *(n=164)*	0.57** *(n=157)*	-			
GEN	0.11 *(n=162)*	-0.01 *(n=167)*	-0.04 *(n=155)*	0.07 *(n=167)*	-0.01 *(n=157)*	-0.14 *(n=157)*	0.04 *(n=167)*	-		
AGE	0.29** *(n=162)*	-0.39** *(n=166)*	0.17* *(n=164)*	0.17* *(n=166)*	0.17* *(n=164)*	-0.14 *(n=156)*	-.31** *(n=166)*	-0.13 *(n=166)*	-	
ZC	0.12 *(n=167)*	0.17* *(n=167)*	-0.04 *(n=152)*	0.16* *(n=167)*	-0.01 *(n=162)*	-0.14 *(n=158)*	-0.03 *(n=164)*	0.15 *(n=164)*	-0.13 *(n=166)*	-

*Correlation is significant at the 0.05 level
** Correlation is signifcant at the 0.01 level
Note: INT=intention, CG=cholesterol guidelines, DZ=disease index, BMI=body mass index, R/E=race/ethnicity (0=white, 1=non-white), INS=insurance (0=no insurance, 1=has insurance), INC=income, EDU=education, GEN=gender (1=male, 2=female), ZC=zipcode (1=rural, 2=urban)

Backward stepwise regression was then used to examine meeting cholesterol screening recommendations as a means of identifying the best fitting model. After two steps, the final model was statistically significant (χ^2 = 50.16; p = 0.00), with perceived barriers, insurance, age, disease index, and BMI significantly related with meeting cholesterol screening recommendations.

Table 20

Logistic Regression Model Predicting Meeting Cholesterol Guidelines with Significant HBM Constructs and Demographic or Health Variables

	β	S.E.	Wald	df	*p*-value	Exp(B)	95% C.I. (lower, upper)	
SS	-0.20	0.319	0.004	1	0.950	0.980	0.524	1.833
BA**	-0.750	0.363	4.275	1	0.039	0.472	0.232	0.962
INS**	2.057	0.491	17.583	1	0.000	7.823	2.991	20.461
Age*	0.037	0.021	3.125	1	0.077	1.038	0.996	1.081
DZ**	0.798	0.384	4.325	1	0.038	2.222	1.047	4.715
BMI*	0.062	0.034	3.240	1	0.072	1.064	0.995	1.137

*Approaches statistical significance (p≤0.10)
**Statistically significant (p≤0.05)
Note: n=170; β=standardized beta weight, S.E.=standard error, Wald=wald statistic, df = degrees of freedom, C.I.=confidence interval, HBM=Health Belief Model, SS=perceived susceptibility, BA=perceived barriers, INS=insurance status (0=no insurance, 1=has insurance), DZ=disease index, BMI=body mass index.

Perceived barriers (p<0.05) was the only HBM construct that was significantly related with meeting cholesterol screening recommendations while controlling for associated demographic and health variables. Insurance status, age, disease index, and BMI were also significantly related with meeting cholesterol screening guidelines. Specifically, perceived barriers were negatively related with meeting current cholesterol screening guildelines, where greater perceived barriers was associated with not meeting the recommendations. Insurance status (having insurance), older age, higher disease index (more diseases), and a higher BMI were positively related with meeting cholesterol screening guidelines (see Table 21).

Next, two logistic regression models were examined with intention to screen cholesterol in the next month as the depedent variable and the HBM constucts perceived susceptibility and perceived barriers as the independent variables, along with all significant demographic and health variables from birvariate analyses (current cholesterol screening, disease index, BMI, race/ethnicity, income, education, and age).

Table 21

Backward Stepwise Logistic Regression Model Predicting Meeting Cholesterol Screening Guidelines.

	β	S.E.	Wald	df	*p*-value	Exp(B)	95% C.I. (lower, upper)	
BA**	-0.754	0.356	4.479	1	0.034	0.470	0.234	0.946
INS**	2.052	0.482	18.083	1	0.000	7.780	3.022	20.028
Age*	0.037	0.020	3.207	1	0.073	1.037	0.997	1.080
DZ**	0.788	0.344	5.251	1	0.022	2.198	1.121	4.312
BMI*	0.061	0.033	3.422	1	0.064	1.063	0.996	1.134

*Approaches statistical significance ($p \leq 0.10$)
**Statistically significant ($p \leq 0.05$)
Note: n = 170; β=standardized beta weight, S.E.=standard error, Wald=wald statistic, df=degrees of freedom, C.I.=confidence interval, BA=perceived barriers, INS=insurance status (0=no insurance 1=has insurance), DZ=disease index, BMI=body mass index.

The first logistic regression model was conducted by entering all significant demographic and health variables related with meeting guidelines in bivariate analyses, in addition to the HBM constructs of perceived susceptibility and perceived barriers. This model was significant ($\chi^2 = 39.22$ with p = 0.00), and the only significant variable was race/ethnicity, although perceived barriers and BMI approached significance. Specifically, non-whites, with fewer perceived barriers, and a higher BMI were more likely to report intention to screen cholesterol in the next month (see Table 22).

Table 22

Logistic Regression Predicting Intention to Screen Cholesterol in the Next Month Using HBM Constucts and Demographic and Health Variables

	B	S.E.	Wald	df	*p*-value	Exp(B)	95% C.I. (lower, upper)	
SS	0.203	0.266	0.579	1	0.447	1.225	0.727	2.063
BA*	-0.577	0.303	3.631	1	0.057	0.561	0.310	1.017
R/E**	1.596	0.507	9.922	1	0.002	4.932	1.827	13.311
DZ	0.223	0.244	0.833	1	0.361	1.250	0.774	2.017
EDU	-0.175	0.218	0.640	1	0.424	1.021	0.548	1.288
Age	0.021	0.015	1.901	1	0.168	1.021	0.991	1.052
BMI*	0.049	0.027	3.264	1	0.071	1.050	0.996	1.107

*Approaches statistical significance (p≤0.10)
**Statistically significant (p≤0.05)
Note: n=170; β=standardized beta weight, S.E.=standard error, Wald=wald statistic, df=degrees of freedom, Exp(B)=odds ratio, C.I.=confidence interval, SS=perceivedsusceptibility, BA=perceived barriers, R/E=race/ethnicity (0=white, 1=non-white), DZ=disease index, EDU=education, BMI=body mass index.

Backward stepwise regression was then conducted. After five steps, the final model was statistically significant (χ^2 = 33.06; p = 0.00), and race/ethnicity, age, and BMI were the only significantly related variables. Older non-whites with a higher BMI were significantly more likely to intend to have their cholesterol screened in the upcoming month (see Table 23).

Table 23

Backward Stepwise Logistic Regression Model Predicting Intention to have Cholesterol Screened in the Upcoming Month

	β	S.E.	Wald	df	*p*-value	Exp(B)	95% C.I. (lower, upper)	
R/E**	1.756	0.459	14.643	1	0.000	5.787	2.355	14.221
Age**	0.038	0.013	8.443	1	0.004	1.039	1.012	1.065
BMI**	0.054	0.025	4.586	1	0.032	1.056	1.005	1.110

**Statistically significant (p≤0.05)
Note: n=170; β=standardized beta weight, S.E.=standard error, Wald=wald statistic, Exp(B)=odds ratio, df=degrees of freedom, C.I.=confidence interval,R/E=race/ethncity (0=white, 1=non-white), BMI=body mass index.

CHAPTER FIVE

Discussion

Introduction

The purpose of this study was was to develop HBM construct scales to better understand the use of cholesterol screenings in rural communities in central Texas, and to subsequently examine relationships among HBM constructs, current cholesterol screening behavior, and intention to participate in a future cholesterol screening. The sample included members (*N*=170) of three rural communities in central Texas. Data were collected using the cholesterol screening behavior scales developed for this study, which measured HBM constructs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy). In addition, current cholesterol screening behavior, intention to screen cholesterol, and demographic and health variables were also included. The survey was dissemeniated through various aspects of the community (e.g., school system, churches, Bingo, etc).

The theoretical framework for this study was the HBM, which was developed to understand why people failed to participate in disease prevention programs (Champion & Skinner, 2008). HBM has six main constucts, five of which were used in this study: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy. A crticial review was conducted by Janz and Becker (1984) of all HBM studies conducted between 1979 and 1984, which is the most current review of HBM studies (Champion & Skinner, 2008). This review found perceived barriers to be the single strongest predictor of behavior in the model with 21 out of 23 studies showing significance. Perceived susceptibility (significance in 20 out of 24 studies) and perceived benefits (significance in 21 out of 26 studies) remained important overall, perceived susceptibility specifically with regards to preventative behaviors. Perceived severity was found to be the weakest predictor within the HBM; significance was detected in 16 out of 26 studies (Janz & Becker, 1984). The Janz & Becker (1984) study was conducted before self-efficacy was added to HBM, thus there was no report of self-efficacy within this study.

Research Questions

To examine the validity and reliability of the HBM construct scales and to understand the use of cholesterol screening in rural communities in central Texas, the following research questions were examined:

Question 1: Are the developed HBM measures valid and reliable?

Question 2: Are were the perceived susceptibility and severity of high cholesterol in rural communities in Central Texas?

Question 3: What are the perceived benefits and barriers of participating in cholesterol screenings in rural communities?

Question 4: What is the level of self-efficacy to perform cholesterol screenings in rural communities?

Question 5: Are constructs of the HBM related to current cholesterol screening use?

Question 6: Are HBM constructs associated with intention to engage in future cholesterol screenings?

Question 7: Does insurance status (or other demographic variables) influence the relationships examined in research questions 5 and 6?

Discussion

Research Question 1

1. Are the developed HBM measures valid and reliable?

Perceived susceptibility. Perceived susceptibility was measured using seven items. Of those seven items measured, five items (SS3-SS7) were taken directly from the HBCVD scale (Tovar et al., 2010) and maintained the exact wording as the original scale. The remaining two perceived susceptibility items (SS1-SS2) were developed through an expert panel review. EFA revealed all seven items to be appropriate for the scale with factor loadings ranging from 0.75 to 0.88 and a Cronbach's alpha of 0.92. This finding is consistent with, or even stronger than, the original scale from which five of the seven items for the scale derived. Tovar et al. (2010) found the factor loadings to range from 0.62 to 0.79 and a Cronbach's alpha of 0.91 for the scale. Differences in factor loading in comparing this study with Tovar's were seen in the five items which ranged, in the current study, from 0.81 to 0.88 and were higher than Tovar et al's (2010) loadings for the same items. The discrepancies within factor loadings may be due to the differences between the sample participants. Tovar's sample was adults with type 2 diabetes from a cardiovascular and diabetes clinic in Texas which may have different factors that could influence perceived susceptibility compared to rural adults that may or may not possess diabetes or CVD. The Cronbach's alphas were comparable between the two scales.

Perceived severity. Perceived Severity was measured using eight items, seven (SV2-SV8) of which were developed using items from the HBM scale for breast self-exams (Champion, 1984). The remaining item (SV1) was developed through the expert panel review. EFA retained three items (SV6-SV8) within the scale. Two of these items (SV6, SV7) were taken from Champion's HBM scale and modified to use language surrounding cholesterol screenings and heart disease. The EFA analysis revealed the three items to have factor loadings ranging from 0.82-0.91 with a Cronbach's alpha of 0.84. Items SV6 and SV7 were adapted from two of Champion's items which had original factor loadings ranging from 0.36 to 0.66 within a severity scale that reported a Cronbach's alpha of 0.78. These adapted items reported factor loadings of 0.91 and 0.89 in the current study. In other uses of Champion's scale, the severity scale has actually been removed due to low factor loadings (0.36-0.66) and low predictability within the model (Champion & Skinner, 2008). The higher factor loadings in the current study may be due to using fewer items to understand the construct of severity (three instead of twelve). It is also possible that the three identified items are the most important as indicated by strong factor loadings on a single-factor. The Cronbach's alpha of the current scale does fit within the range of Champion's scale and other adaptations of her severity scale which have alphas that range 0.75 to 0.85 (Champion & Skinner, 2008).

The construct of perceived severity consistently fails to predict behavior, even when perceived severity was high among the sample population. This has been seen with self-breast exams, (Champion, 1984; Champion, 1987; Gray, 1990; Janz & Becker, 1984; Trotta, 1980), CHD (Ali, 2002), Tay-Sachs disease (Becker et al., 1974), and chest x-rays for Tuberculosis (Hochbaum, 1958). In recent studies using HBM, severity scales were left out altogether due to this inability to predict behavior (Champion & Menton, 1997; Champion et al., 2008; Oliver et al., 2011). The removal of a severity scale in the present study conflicted with the theoretical premise that all six HBM constructs collectively predict behavior (Champion, 1987). However, the high level of severity not predicting behavior is consistent with theoretical intention which supposes that severity was related to not partaking in a preventive screening (Champion, 1987).

Perceived benefits. Perceived benefits were measured using a four-item scale. One item (BN2) within this scale was derived from Champion's original 5-item benefits subscale in the HBM scale (Cronbach's alpha=0.61) with modifications in the terminology to fit the concept of cholesterol screenings and CVD. The remaining three items (BN1, BN3, BN4) were derived through the expert panel. EFA was conducted on this scale and all items were retained in the scale. All factor loadings were within the range of 0.60-0.73, where Champion's original benefits factor loadings ranged from 0.40 to 0.66. The Cronbach's alpha within the current study (0.83) is acceptable and similar, if not stronger than the Cronbach's alpha scores reported by Champion (0.61-0.87). Previous literature support benefits as significant with respect to behavior, although in most studies benefits has not been strongly related (Champion, 1987).

Perceived barriers. Perceived barriers were measured using 16 items. Five items (BA4-BA8) were adapted from the barrier subscale in the Champion's HBM scale (1984), which had eight items and a Cronbach's alpha of 0.76. Three items (BA9, BA10, BA13) were derived from Guvenc et al.'s barrier scale within the HBM scale for Cervical Cancer and Pap Smear Test (2011), which had 14 items and a Cronbach's of 0.82. The remaining eight items (BA1-BA3, BA11-BA12, BA14-BA16) were developed based on qualitative research that defined barriers faced by rural community members in the access and utilization of healthcare (Goins et al., 2005; Strickland & Strickland, 1996).

EFA was conducted with the barriers items. Six items within two factors remained in the scale (Factor1: BA12, BA15, BA16 and Factor 2: BA7, BA9, BA10). Factor 1 (access to healthcare professionals) had factor loadings ranging between 0.81 and 0.88. The items within Factor 1 were all developed based off of the qualitative research conducted with rural populations; however, only one of these (transportation) has been identified consistently as a strong barrier in the current literature (Goins et al., 2005; Strickland & Strickland, 1996). Although trust and the ability to talk with and understand healthcare professionals have been identified as barriers within qualitative research, they have not been identified as strong barriers within quantitative barrier research.

The most common barriers derived from previous qualitative data were transportation difficulties, financial constraints (cost), thought of services not being needed, and lack of insurance coverage (Casey, Thiede, & Klingner, 2001; Goins et al., 2005; Strickland & Strickland, 1996). The items that addressed other qualitatively identified barriers were not retained in the model (e.g., cost and availability of screenings). It is possible that the similar wording used within items BA12, BA15, and BA16 around healthcare providers allowed them to have stronger factor loadings, while other barriers were removed. The wording of these items should also be considered due to the distinctiveness of the way they were worded in respect to the other items. For example the items stated the participant did not participate in the screening "because" followed by a reason. However, factor loadings for these three items were greater than the acceptable 0.40 for factor loading and were retained within factor 1.

Factor 2 (inconveniences) had factor loadings ranging from 0.74 to 0.87. Item BA7 (0.74), which was adapted from Champion's scale, was higher than the factor loading range of Champion's scale which was 0.43 to 0.71. Items BA9 (0.87) and BA10 (0.87) were adapted from Guvenc's scale. The items in this study had factor loadings greater than the original items which had factor loadings of 0.30 and 0.55. Again, the higher factor loadings may be due to using fewer, more similar items to understand the entire construct. The model in the current scale used two-factors and six items to understand barriers. Champion's scale used eight items and Guvenc's scale used 14 items. The Cronbach's alphas were 0.76 for Champion's barriers scale and 0.82 for Guvenc's barriers scale, where the current study's Cronbach's alpha was strong (α=0.84).

Self-Efficacy. Self-efficacy was measured with ten items derived from the SES-PSSP (Hogenmiller et al., 2007). The original scale had 20-items (Cronbach's alpha=0.95), but some were not selected for adaptation for this study because they were not applicable to all members of the population being measured (e.g. living in a drug treatment center or on street drugs).

EFA was conducted for the self-efficacy items, which resulted in a two-factor scale with three items within each factor. This was consistent with Hogenmiller et al.'s (2007) study in which two factors were revealed: Factor 1: personal costs and Factor 2: relationships. Interestingly, the items in this study fell within the same factors as the original items in Hogenmiller's study. In this study, Factor 1: personal costs included items SE1, SE2, and SE3, which had factor loadings of 0.86, 0.85, and 0.71 respectively.

These were slightly lower than the factor loadings in Hogenmiller's study of 0.87, 0.86, and 0.80, but were still very strong and well above the inclusion criteria. In Hogenmiller's study the factors were measured individually, and factor 1 reported a Cronbach's alpha of 0.93 (for a total of 10 items).

In this study, Factor 2 (relationships) included items SE5, SE7, and SE9, which had strong factor loadings of 0.73, 0.78, and 0.80, respectively, compared to Hogenmiller's factor loadings of 0.83, 0.73, and 0.60 for the same items. Hogenmiller et al. reported a Cronbach's alpha for factor 2 of 0.90 (which included eight total items). The current study measured factors 1 and 2 as the same construct and reported a Cronbach's alpha of 0.75. The higher Cronbach's alpha in Hogenmiller's scale might have been due to inclusion of more items that were strongly related to understand self-efficacy within a given population. Another point to note is that Hogenmiller used the factors as separate sub-scales to predict behavior, unlike the current study which used the factors together within the construct of self-efficacy.

Research Question 2

2. What are the perceived susceptibility and severity of high cholesterol in rural communities in Central Texas?

The most frequently reported susceptibility items were SS1: "I have or will probably develop high cholesterol during my life" and SS2: "I worry about having high cholesterol". This is interesting considering these two items refer to susceptibility of high cholesterol versus items SS3-SS7 which refer to susceptibility of Heart Attack or Stroke (HA/S). Items SS1 and SS2 were reported at least 10% more than the other items. The least reported susceptibility item was SS4: "My chances of suffering from HA/S in the nest few years is great." This indicates that there is a low perception of having a HA/S now (19.4%), but according to the reported frequency of item SS5 there is a somewhat higher percentage of the sample population who think they will have a HA/S in their life (31.2%).

There seems to be a disconnect between susceptibility to high cholesterol and the relationship between high cholesterol and having a HA/S. Since cholesterol screening behavior has not been previously been studied, there are no previous frequencies to compare to the frequencies of this study. However, the lower perceived suceptibility to HA/S in this studywas consistnent with studies that have been conducted using rural communities in West Virginia (Krummel, Humphries & Tessaro, 2002) and Alabama (Hamner & Wilder, 2010). Hamner and Wilder (2010) discovered that only 30% of women identified heart disease/heart attack as a serious illness faced by women, but 83% of the women indentified their risk of developing any form of CVD to be between 41-80%. The qulatitaive work conducted by Krummel et al. (2002) revealed women had higher perceived susceptibility to breast cancer although their susceptibility to HA/S increased only if there was a family history of CVD events.

The severity of HA/S seemed to resonate more with the rural communities than susceptibility. The most frequently reported severity items included SV2 "If I had a HA/S it would be hard on my family," SV6: "If I had a HA/S I might not be able to work," and SV7: "If I had a HA/S I wouldn't be able to provide for myself or my family." The most frequently reported severity items were consistent with Krummel et al.'s (2002) work with rural women. Krummel's found that younger women with children had higher perceived severity out of concern for who would provide for their children if they were to experience a cardiac event. Older women were more likely to change behavior based on their perceived severity. The difference between ages supports our findings (see research question 7 below). While severity frequencies were high, they were not significantly related with meeting cholesterol screening behaviors or intention to screen in bivariate analyses. Nor were they related after controlling for the other HBM constructs (please see research questions 5 and 6 below).

Research Question 3

3. What are the perceived benefits and barriers of participating in cholesterol screenings in rural communities?

The four benefit items were all reported by at least 53% of participants. The most frequently reported benefit was BN1: "Knowing my cholesterol level can help me stay healthy," and the least frequent was BN2: "I wouldn't be anxious if I knew my cholesterol." Given these results, most participants associated the benefits of cholesterol screening to being healthier, reducing their risk of HA/S, and being less anxious. This reflected the outcomes of breast cancer screening studies, particularly those looking at self-breast exams (Champion, 1984; Champion, 1987; Gray, 1990). Gray (1990) conducted a study using HBM with rural women to understand the practice of breast self-examinations. She found that women must believe there is a benefit to be gained by participating in the behavior, the most common benefit noted was reducing the severity of breast cancer through early detection. Champion's (1987) study showed benefits to have low correlations with behavior however, thus benefits were removed from Champion's final model due to low account for variance.

Barrier items were gathered and modified from various soucres, such as Champion's HBM scale (1984), Guvenc's HBM scale (2011), and qualitative data from rural studies by Strickland and Strickland (1996) and Goins et al. (2005). The most commonly reported barriers were BA1: "Knowing my cholesterol level doesn't keep me from having a heart attack or stroke" and BA9: "It is hard for me to remember to get my cholesterol checked." BA1 presents a similar issue to what was identified with the susceptibility items, there seems to be a lack of connection between cholesterol levels and HA/S for the participants (Ali, 2002; Deskins et al., 2006; Krummel et al, 2002). This conclusion was supported by Krummel and colleagues' focus groups with rural women in West Virginia, who when asked about behaviors they could change to lower their risk of CVD did not believe changing their eating behaviors contributed to their risk. While this was not a direct support for cholesterol levels, there was a picture of the lack of knowledge in the relationship between food and risk for HA/S. The missing link between food and that risk was the cholesterol build-up due to food intake (Krummel et al., 2002). Ali's (2002) study of CHD in women revealed similar results in that only half of the sample identified high fat diets, high cholesterol levels, or hypertension as risk factors for CHD and even fewer identfied diabetes or obesity as risk factors.

While barriers were significantly related with behavior (discussed later in research questions 5, 6, and 7), lower frequencies for barriers does not quite match literature on rural communities. Qualitative literature identifies high barriers to health care access as one of the largest indicators for healthcare disparities among rural populations, in comparison to their non-rural counterparts (Goins et al., 2005). The most commonly identified barriers to utilization were transportation difficulties, limited healthcare supply, lack of quality health care, financial constraints, and social isolation. However in this study, only transportation remained in the scale. The results show that some barriers have higher frequencies which supports barriers identified in qualitative research (Casey et al., 2001; Goins et al., 2005; Strickland & Strickland, 1996). The differences in population could be one reason that the barriers retained in the current scale differ from the qualitative research. Goins et al. (2005) studied rural older adult populations and Strickland and Strickland (1996) studied rural minority populations. The current study sample was unique in that the population was predominantly white (75%) with an average age was 45 years. There was also the probablity (addressed above) that the wording of items may have caused certain items to stay within the scale, and others to be removed.

Research Question 4

4. What is the level of self-efficacy to perform cholesterol screenings in rural communities?

Self-efficacy scores ranged from one to five, with one being low self-efficacy (very unlikely to be screened) and five being high self-efficacy (very likely to be screened). The mean score for this scale was 3.01 (SD=0.83) which corresponded with the sample being neutral within the range of self-efficacy. The items with the lowest likelihood in the scale were SE1: "if it is hard to get a doctor to take your insurance" and SE2: "if you don't have a doctor." The items which revealed the highest likelihood were SE5: "If a close friend or family member tells you a screening is needed" and SS9: "If your last screening was abnormal." Although this is the first self-efficacy scale for cholesterol screening behavior, in comparing these results with other self-efficacy measures, the current study's self-efficacy scale was lacking in that it was not related with behavior. Self-efficacy has been consistent in its relationship with and prediction of preventative health behaviors and intention (Fernandez et al., 2009; Hogenmiller et al., 2007; Sol, Graaf, Petersen, & Visseren, 2010).

Research Question 5

5. Are HBM constructs related to current cholesterol screening utilization?

The basis for measuring current cholesterol screening was the AHA's current guidelines for having cholesterol screened within the last five years (AHA, 2011). Based on the correlation matrix and one-way ANOVAs, the HBM constructs of susceptibility ($p<0.01$) and barriers ($p<0.05$) were the only constructs significantly related with meeting current guidelines. It is not surprising that perceived severity was not related with behavior; as that was consistent with literature surrounding HBM and preventive health screenings (Ali, 2002; Champion, 1984; Champion & Skinner, 2008). Perceived severity has consistently not predicted or been related with behavior (Janz & Becker, 1984). The lack of correlations among benefits, self-efficacy, and meeting cholesterol guidelines were more interesting. When the Pearson's and point biserial correlations were examined further we saw that benefits were significantly related ($p<0.01$) with perceived susceptibility and perceived barriers ($p<0.01$), which could explain why it did not correlate with behavior. This was consistent with Champion's (1987) study of breast self-exams in which benefits was removed from the model after multiple regression analysis because its clinical significance, if assessed with barriers, was too low and benefits did not account for additional variance. Self-efficacy also had a significant relationship with barriers ($p<0.01$) which may explain the lack of a significant relationship with behavior. This finding was consistent with some of the results in the original self-efficacy scale by Hogenmiller et al (2007). Hogenmiller et al. conducted a logistic regression using each factor separately to predict behavior, and found that that self-efficacy Factor 1 (relationships) was not significantly related with behavior. In this current study, self-efficacy was used as one construct with two factors, resulting in the construct as a whole not being significantly related (Hogenmiller et al., 2007). Future research should examine these relationships using the two self-efficacy factors separately to see if each of the factors might individually be significantly related with behavior.

The relationship between perceived susceptibility and meeting guidelines was positive, while the relationship between perceived barriers and meeting guidelines was negative. The relationships seen in this correlation matrix were consistent with the relationships seen between HBM constructs and other behaviors such as breast self-exams and healthcare utilization in rural communities. Higher barriers are negatively related with behavior, thus the more barriers faced by a person, the less likely the person was to participate in the behavior (Champion, 1984; Champion, 1987; Trotta, 1980). The positive relationship between perceived susceptibility and current screening behavior was consistent within some research using HBM to predict behavior (Champion et al., 2008; Champion & Skinner, 2008; Janz & Becker, 1984). However, the predictability of perceived susceptibility has not been constant throughout its use. Some studies, particularly within breast self-exams, have found the relationship between perceived susceptibility and behavior to be insignificant (Champion, 1987; Trotta, 1980).

The subsequent logistic regression analysis was conducted using the meeting current cholesterol screening behaviors as the dependent variable, and significant HBM constructs, perceived susceptibility and perceived barriers, as the independent variables. Based on the results of the logistic regression both perceived susceptibility and barriers remained significantly related with current behavior. Participants were 1.97 times more likely to meet cholesterol guidelines for every increase of their susceptibility score. While the more barriers a participant had, the less likely (0.46 times less likely) they were to meet the current guidelines for cholesterol screening.

Research Question 6

6. Are HBM constructs associated with intention to engage in future cholesterol screenings?

Based on the Pearson's correlations and one-way ANOVAs, the HBM constructs of perceived susceptibility ($p<0.01$) and perceived benefits ($p<0.05$) were significantly and positively related to intention to screen cholesterol in the next month. Also based on these results there was a negative relationship between perceived barriers and intention that approached significance ($p=0.07$). However, perceived severity and self-efficacy were not related with intention to perform the behavior. Perceived severity was significantly related to perceived susceptibility ($p<0.01$) and perceived benefits ($p<0.01$) while self-efficacy was significantly related to perceived benefits ($p<0.01$). As discussed previously, in the current literature perceived severity has not shown to have the ability to predict behavior or intention (Ali, 2002; Champion, 1984; Champion & Skinner, 2008; Janz & Becker, 1984).

A subsequent logistic regression showed that the only HBM constructs significantly related with intention were perceived susceptibility and perceived barriers, when controlling for the other HBM constructs found to be significantly related with intention in bivariate analyses. Specifically, as susceptibility scores increased, the likelihood of intention increased by 2.22 times. This was consistent with previous literature published on both prostate cancer screening and hepatitis C screening (Lu et al. 2010; Oliver et al., 2011). The increase in barriers scores decreased the likelihood of intention to get screened by 0.57 times. Benefits were removed from the final model. One potential explanation for why benefits did not remain significantly related with intention while controlling for perceived barriers and perceived susceptibility could be explained by the strong correlations between the constructs, as perceived benefits were significantly related with both perceived susceptibility ($p<0.01$) and perceived barriers ($p<0.01$). This was consistent with Champion's (1987) work which showed that even when benefits were related with behavior and intention; it was removed during logistic regression due to its inability to account for variance when examined with barriers.

Research Question 7

7. Does insurance status (and other demographic and health variables) influence the relationships examined in research questions 5 and 6?

Pearson's and point biserial correlations as well as logistic regression analyses were used to answer research question 7. The answers are discussed below beginning first with research question 5, meeting guidelines for cholesterol screening, and then addressing research question 6, intention to screen cholesterol in the next month.

Meeting AHA guidelines for cholesterol screenings. In order to understand the influence of demographic and health variables on the relationships among HBM constructs and meeting guidelines for cholesterol screening, Pearson's and point biserial correlations between meeting guidelines and demographic/health variables were examined. Results revealed significant and positive relationships between meeting cholesterol guidelines and a greater disease index ($p<0.01$), higher BMI ($p<0.05$), being insured ($p<0.01$), and older age ($p<0.01$).

The first logistic regression analysis revealed that perceived barriers, having insurance, older age, a greater disease index, and a higher BMI were all significantly and positively associated with meeting guidelines for cholesterol screening ($\chi^2=50.16$, $p=0.00$). The only factor not significantly related was perceived susceptibility. Subsequent backward stepwise regression was then conducted and resulted in a final model where fewer barriers, being insured, older age, greater disease index, and higher BMI were retained in the model explaining meeting guidelines for cholesterol screening ($\chi^2=50.16$, $p=0.00$). Although age and BMI were not significantly related with meeting guidelines ($p>0.05$), they were retained in the model to provide the best fit. All other variables retained in the model were significantly related with meeting cholesterol screening guidelines.

In backward stepwise regression, perceived susceptibility was the only variable not retained in the final model, which could potentially be explained by examining the significant relationships between perceived susceptibility and insurance status ($r=0.16$, $p=0.05$), age ($r=0.38$, $p=0.00$), disease index ($r=0.54$, $p=0.00$), and BMI ($r=0.31$, $p=0.00$).

The relationship between insurance status and meeting guidelines was significant ($p=0.00$) with a substantial odds ratio (7.78). This means that each person with insurance was 7.78 more likely to meet cholesterol screening guidelines. Since insurance would reduce the cost related for someone to get their cholesterol checked, this could explain the strength of this relationship. It was also probable that someone who had insurance was also more likely to visit the doctor more often, making it more likely that they have had their cholesterol checked within the last five years (Casey et al., 2001).

The relationship between disease index and meeting guidelines is also significantly strong with an odds ratio of 2.20. This means that the more diseases a person possessed, the more likely they were to have had their cholesterol checked within the recommended guidelines. The disease index took the survey categories (diabetes, heart attack, angina, high blood pressure, heart bypass surgery or stent, congestive heart failure, high blood cholesterol, and stroke) and categorized participants by the number of diseases they had. The disease index reported 45.4% to have at least one of the diseases. If the diseases are looked at by frequencies, 25.9% of the participants had high cholesterol, 30% had high blood pressure, and 14.7% had diabetes. Given these frequencies, it is not surprising that the disease index was strongly related with having met the guidelines. Since 25.9% of the population had been diagnosed with high cholesterol, this would most likely indicate that they have had their cholesterol checked. A high percentage of participants also reported high blood pressure and diabetes, both of which are diseases that are risk factors for and influenced by cholesterol levels, making it likely that they have had their cholesterol checked as well (AHA, 2011). It is likely that the people with high cholesterol, high blood pressure, and/or diabetes are some of the same people across categories since the disease index shows 15.9% to have two of the mentioned disease, 5.3% to have three, and 2.4% to have four or more. It is likely that those who have a CVD related illness have in fact met the guidelines for cholesterol screening. Over half of the sample (54.7%) reported not having any of the listed diseases which may lower their likelihood of having been screened. This assumption would be consistent with the relationships found in this study.

A fifth result to note is the negative (significant) relationship between perceived barriers and meeting guidelines. The relationship indicated that the more barriers a person faced, he/she was 0.47 times less likely to meet the established guidelines. The barriers represented by this scale were transportation, trust, remembering, and priorities. These items were consistent with the reported barriers in rural communities (Goins et al. 2005; Strickland & Strickland, 1996).

Finally, although age and BMI were not significantly related with cholesterol screening behavior, they remained in the model. In considering the role of age, older age is generally accompanied by increased disease and more awareness of mortality (Guibert et al., 1999; Hamner & Wilder, 2010; Stimpson & Wilson, 2009). As BMI increases, so does the risk for disease, specifically high blood pressure, high cholesterol, and diabetes due to excess weight gain (Krummel et al., 2002).

Intention to get cholesterol screened. In order to understand the influence of demographic and health variables on the relationship between HBM constructs and intention to screen cholesterol, Pearson’s and point biserial correlations were examined first. The correlation matrix showed significant relationships between intention to participate in cholesterol screening and perceived susceptibility ($p<0.01$), perceived benefit ($p<0.05$), disease index ($p<0.01$), BMI ($p<0.05$), race/ethnicity ($p<0.01$), income ($p<0.01$), education ($p<0.01$), and age ($p<0.01$). Perceived barriers were approaching significance ($p=0.07$). However, insurance status was not related with intention to get cholesterol screened. The lack of relation between insurance status and intention may be due to the higher correlation between those who had insurance status and meeting current cholesterol guidelines; which would mean that those who had insurance were likely to already have been screened and would not need to be screened again within the next month. The remaining participants without insurance status would not have been screened which then makes sense that they may have greater intention to be screened.

Based on significant bivariate relationships, the first logistic regression analysis included perceived susceptibility, perceived benefits, perceived barriers, race/ethnicity, disease index, education, age, and BMI. However, the only significant variable in the model was race/ethnicity, with perceived barriers (p=0.06) and BMI (p=0.07) approaching significance. Backward stepwise regression was then conducted and resulted in a final model which included race/ethnicity, age, and BMI (χ^2=33.06; p = 0.00). The resulting model undermined the assumptions that HBM constructs would predict intention, as both perceived susceptibility and barriers were removed from the model using backwards stepwise regression. Perceived susceptibility was strongly related with race/ethnicity (r= 0.25, p=0.00), age (r=0.38, p=0.00), and BMI (r=0.31, p=0.00). This high correlation between perceived susceptibility and these factors potentially could explain why the construct was not included in the model. In Champion's (1987) study of breast self-exams, a similar result occurred where perceived susceptibility was removed from the model. She stated that the theoretical framework of HBM suggests that a participant's perceived susceptibility would decrease after a preventative action was taken. Thus, the participant would have a lower likelihood of intention to participate in another screening (Champion, 1987). It is likely that the same thing happened in this sample, especially since the AHA's recommendations for cholesterol screenings is every five years.

The removal of perceived barriers in the backwards-stepwise regression was interesting since perceived barriers was only significantly related to age ($p=0.03$), which would not wholly account for its removal from the model. The removal of perceived barriers was inconsistent with the current literature which shows barriers to be predictive of intention (Champion, 1984; Champion, 1987; Champion & Skinner, 2008; Champion et al., 2008; Janz & Becker, 1984). Part of this inconsistency might also be explained by the relatively low sample size used in this study. Based on original sample size calculations for this study, a sample of at least 230 was determined to establish the power and validity for this survey, since that sample size was not achieved this study may have inadequate power to detect all relationships (Garson, 2008). Future research should use a larger sample size in order to re-examine this analysis. It may also be that perceived barriers need to be examined within the categories of race/ethnicity, age, and BMI. Future research should examine relationships by these categories.

The final model consisted of race/ethnicity ($p=0.000$), age ($p=0.004$), and BMI ($p=0.03$). Race/ethnicity had a very high correlation with intention ($r=0.45$, $p=0.00$) and a strong odds ratio with intention in this final model. According to the results of this study, being non-white (defined as being Hispanic, African American, Asian/Pacific Islander, or other) made a participant 5.79 times more likely to intend to have his or her cholesterol screened. This result is not consistent with the current literature with rural communities, which indicates that minorities were less likely to engage in preventative behaviors (Strickland & Strickland, 1996). It is important to note here that rural America is not homogenous. Weinert and Long (1990) frequently address the diversity of rural communities in their research, classifying regional diversity as an "essential consideration when identifying rural health care needs" and stating that "it is reasonable to expect that health differences among various rural areas and subgroups may be pronounced" (Strickland & Strickland, 1996; Weinert & Long, 1990). Given the diversity of rural America it is possible that there are differences in minorities seeking healthcare in communities in central Texas and other rural populations in the United States. For these communities, it may be that minorities have higher intentions to get screened because whites are more likely to have insurance and have previously checked their cholesterol (Casey et al., 2001; Strickland & Strickland, 1996). Since cholesterol screening guidelines recommend screening every five years, those who have previously been screened would have no intention of getting screened in the next month.

Other factors that contributed to the final model, age and BMI were also significantly related with intention to be screened and had strong odds ratios as well. The relationship between age (p=0.00) and intention showed, the older a participant gets, he or she is 1.04 times more likely to intend to check his or her cholesterol. This relationship gives insight into age being a predictor of intention which could be due to maturity of the person, insight into their own mortality, or connection with greater diseases seen in people as they age (Hamner & Wilder, 2010). The findings on age are consistent with the literature which found age, particularly over 50, to be a predictor of intention to screen cholesterol levels (Stimpson & Wilson, 2009). The model indicated that increases in BMI (p=0.03) were associated with a participant being 1.06 times more likely to intend to get their cholesterol screened. This finding is possibly related to the amount of disease linked with obesity. Future research should analyze HBM constructs based on age, race/ethnicity, and BMI categories to see if there is potential moderation.

Implications

The current study supports the use of the HBM in understanding cholesterol screening behaviors in rural communities. The findings of this study were consistent with cancer screening literature in regards to the relationship between perceived susceptibility and intention (Lu et al. 2010; Oliver et al., 2011), the relationship between barriers and rural behavior (Goins et al., 2005; Strickland & Strickland, 1996), and the relationship between severity and prediction of behavior (Champion, 1984; Champion & Skinner, 2008; Janz & Becker, 1984).

This study was unique in that it used a theoretical framework to examine cholesterol screening behavior. Cholesterol screening behavior has rarely been studied in terms of understanding the actual behavioral aspects of cholesterol screening, and the studies that do exist have been entirely qualitative (Deskins et al., 2006). In this study we developed the first quantitative measures for HBM constructs regarding cholesterol screening behavior. The current body of literature focuses on cholesterol levels, outcomes of screening for cholesterol levels, and patient satisfaction with cholesterol screenings. This study looked at why a person chooses (or refuses) to participate in a cholesterol screening.

The use of a theoretical framework is also unique to this area of study. There were ten studies identified that addressed cholesterol screenings, and only five used a theoretical framework for the study (Anderson et al., 2011; Burke et al., 2003; Deskins et al., 2006; Guibert et al., 1999; Spoon et al., 1997). This study was also unique in that rural communities in central Texas were studied, which have different demographic characteristics as compared to other rural areas in Texas and other parts of the country. The study supported the use of HBM constructs of perceived susceptibility, perceived benefits, and perceived barriers to understand cholesterol screening behavior in rural communities in central Texas. The constructs within the study also identified areas of knowledge that were lacking as well as barriers that need to be addressed within rural communities.

This research has several implications for researchers and health practitioners who desire to help identify CVD risk in rural populations. This research gives insight into the strongest predictors of behavior, including the large barriers faced by people residing in rural communities. Healthcare practitioners should be aware of the most prominent barriers and the barriers that were retained in the developed scale, such as the lack of trust and inability to understand health care, since these impact their patients' use of healthcare services. Health educators should also use this information to design better programs to educate rural communities on the importance of understanding their cholesterol levels.

The current results also provide insight into a lack of knowledge of cholesterol and its potential links to CVD. This identifies a need for education in these areas within rural communities. Future research should examine differences across age and ethnic groups, as educational activities may need to be tailored for different age groups and race/ethnicities since those factors are the biggest predictors of intention to perform behavior.

Limitations

There are multiple limitations to this study. The first limitation is that the results of the survey instrument are self-reported. meaning there is no way to verify whether participants actually checked their cholesterol. Disease status, education, and income were also self-reported which could have been inflated or left out due to embarrassment.

Secondly, there is a lack of generalizability and selection bias due to the use of a convenience sample. The convenience sample included members of three rural communities in central Texas. Since the sample was recruited from a rural community in central Texas with a very distinct demographic make-up, it is possible that the results of this survey might not be generalizable to all rural communities, especially those with different demographic characteristics. For example, this rural sample was predominantly white (75.9%) and educated, on average, through the 12th grade, which is very different than other rural areas in Texas and the rest of the United States (Goins et al., 2005; Strickland & Strickland, 1996). This research aimed to reduce selection bias by recruiting through the school system, community health programs, and community activities such as Bingo. However, because of the methods used, it was possible that participants could have worked in the communities but not resided there. Zipcode was asked on the survey to distinguish area of residence. Additionally, zipcode was not related with either dependent variable of interest (current behavior or intention). Given the sample population, this study may be generalizable to neighboring rural communities. The deomgraphic characteristics of the sample population were very reflective of the three communities surveyed, although this sample had a higher average age (45.3 years) than the communities (32.83 years; McNeal et al., 2010) and there were a disproportionately high number of women who completed the survey (77.6%).

Third, this study aimed to use theory to understand cholesterol screening behaviors, which has rarely been done. This presented a limitation because there were often no comparisons for the results seen for the actual behavior. Although, we compared the results of this study to the results of the HBM framework within cancer screening behaviors. The results in this study are reflective of the previous uses of HBM frameworks, giving it support. However, without further research using HBM to understand cholesterol screening, its novelty is a limitation.

Fourth, the survey instrument was developed through the modification of scales unrelated to cholesterol screening. This research study determined which factors within the scale were in fact valid and reliable and, through EFA, establish five scales in which to measure cholesterol screening behavior (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy). Future research needs to conduct a confirmatory factor analysis to further examine further validity and reliability of the scales.

Fifth, this study was a cross-sectional research study design. The cross-sectional design cannot predict behavior because it collected data at one point in time. There was no way to understand the cause-and-effect relationship that might exist between HBM constructs or demographic variables. Therefore, there was no way to know if fewer barriers leads to cholesterol screening or if having cholesterol screening leads to fewer barriers.

Sixth, the small sample size was also a limitation to this study. Despite disseminating 1,125 surveys, only 170 surveys were returned (15.1% response rate). The desired sample size to establish validity and reliability of the HBM scales was five times the number of total items (Garson, 2008). For the 67-item scale developed in this research, the desired sample size was 230. The small sample size may have prevented the detection of significant relationships. It is important to note that there were two different sampling techniques used that may have influenced response rate. The round of data collection consisted of surveys that were sent home with students, which had a low response rate. While the second round of data collection included the researcher showing up to Bingo, personally handing out surveys to participants, and collecting them when participants were through. The possibility of a participant filling out and returning a survey was much higher at Bingo. Future researchers should recognize that person-to-person contact in rural communities may be a better data collection method.

Last, this study reveals potential limitations of the HBM. The data analysis showed that none of the HBM constructs were related with intention. Intention is not a construct within the HBM and comes from TPB. The lack of relationships between intention and HBM constructs questions the model's ability to predict intention to participate in future screening. However, it was evident that, as it was intended, HBM constructs were related with behavior itself. It is also possible that perceived limitations of the HBM may also be influenced by the small sample size available.

Future Research

This research study contributes to the current body of literature by providing validated quantitative scales to measure five HBM constructs as they pertain to cholesterol screening behavior (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy). However, future research should examine these scales and conduct a confirmatory factor analysis with larger and more diverse rural samples. Future research should also strive for a higher response rate. Other states have found rural communities to have between 42-48% response. The current study only achieved a 15.1% response rate. It is advisable that future researchers seek out strong community partners and stakeholders to help advertise and administer the surveys.

The findings of this research support the future use of HBM constructs to understand cholesterol screening behavior and also to understand health behaviors in rural communities, specifically, perceived suceptibility, perceived benefits, and perceived barriers. The findings show perceived susceptibility, perceived benefits, and perceived barriers to be correlated with meeting guidelines and intention in bivariate analyses. However, given the final model revealed by logistic regression, there was a distinct need to further examine these relationships in a larger sample size. Future research might also consider using cues to action to increase participation in a screening behavior. Cues to action may be different depending on the rural community and should be tailored to the appropriate audience.

Beacause none of the HBM constructs were included in the final model examining intention to engage in a future screening, future research should look at HBM constructs by age group, race/ethnicity, and BMI categories. This is necessary to better understand what constructs in HBM are predictive for current behavior and intention. It is also important for future research to use the developed scales in different rural communities to confirm and further examine validity and reliability in diverse rural populations. This would mean that the instument would need to be used throughout rural communities in the United States and possibly tailored for different cultures and socio-demographics. It also means there might be a need to translate the survey into spanish in order to validate the scale among rural communities in states such as Texas, New Mexico, Arizona, and California.

Conclusion

Results of the current study show the utility of HBM constructs in explaining cholesterol screening behavior in rural communities in central Texas. The limitations of this study were self-reported bias, a convenience sample, and sample size. Despite these limitations, barriers were identified that healthcare practicioners and health educators can use to help develop new educational programs. Based on the final logistic regression models, race/ethnicity, age, and BMI were significantly related with intention and perceived barriers, insurance status, age, BMI, and diseases index were significantly related with meeting AHA's cholesterol screening recommendations. Knowing that these factors have a large influence on a person's behavior and intention means that educational programs should foucs on different ages, races, and BMI ranges and also focus on getting rural populations to meet the AHA guidelines for cholesterol screenings.

APPENDICES

APPENDIX A

Survey Instrument

The following statements measure different aspects of belief concerning Heart Attacks and Stroke.

Please circle the number (1-5) which best explains how much you agree with each statement.

Cholesterol is defined as a waxy substance found in the fats in your blood.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I have or will probably develop high cholesterol during my life.	1	2	3	4	5
2	I worry about having high cholesterol.	1	2	3	4	5
3	It is likely that I will suffer from a heart attack or stroke in the future.	1	2	3	4	5
4	My chances of suffering from a heart attack/stroke in the next few years are great.	1	2	3	4	5
5	I feel I will have a heart attack or stroke sometime during my life.	1	2	3	4	5
6	Having a heart attack or stroke is currently a possibility for me.	1	2	3	4	5
7	I am concerned about the chance of having a heart attack or stroke in the near future.	1	2	3	4	5
8	If I have high cholesterol, I will be more likely to have a heart attack or stroke.	1	2	3	4	5
9	If I had a heart attack and stroke, my whole life would change.	1	2	3	4	5
10	Having a heart attack or stroke will cause problems that would last a long time.	1	2	3	4	5
11	If I had a heart attack or stroke it would be hard on my family.	1	2	3	4	5
12	The thought of having a heart attack or stroke scares me.	1	2	3	4	5
13	If I had a heart attack or stroke I might not be able to work.	1	2	3	4	5

14	If I had a heart attack or stroke I wouldn't be able to provide for myself or my family.	1	2	3	4	5
15	My feelings about myself would change if I had a heart attack or stroke.	1	2	3	4	5
16	Knowing my cholesterol level can help me stay healthy.	1	2	3	4	5
17	I would not be so anxious about a heart attack or stroke if I got my cholesterol checked.	1	2	3	4	5
18	When I do cholesterol checks, it is good for my health.	1	2	3	4	5
19	Regular cholesterol checks lower the risk of having a heart attack or stroke.	1	2	3	4	5
20	I don't think it's useful to know my cholesterol level.	1	2	3	4	5
21	Knowing my cholesterol level doesn't keep me from having a heart attack or stroke.	1	2	3	4	5
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
22	It is not easy for me to get my cholesterol checked.	1	2	3	4	5
23	It is embarrassing for me to get my cholesterol checked.	1	2	3	4	5
24	Cholesterol checks can be painful or uncomfortable.	1	2	3	4	5
25	My family would make fun of me if I got my cholesterol checked.	1	2	3	4	5
26	Getting cholesterol checks gets in the way of things I need to do.	1	2	3	4	5
27	Getting my cholesterol checked takes too much time.	1	2	3	4	5
28	It is hard to remember to get my cholesterol checked.	1	2	3	4	5
29	I have other problems more important than checking my cholesterol.	1	2	3	4	5
30	I am able to do everything I want to, so I don't need to get my cholesterol checked.	1	2	3	4	5
31	I do not have transportation to get to the doctor to get my	1	2	3	4	5

	cholesterol checked.					
32	There is nowhere to get my cholesterol checked where I live.	1	2	3	4	5
33	I can't afford to get my cholesterol checked.	1	2	3	4	5
34	I do not get my cholesterol checked because I do not trust healthcare providers.	1	2	3	4	5
35	I do not get my cholesterol checked because I can't understand or talk with my doctor.	1	2	3	4	5

The following statements measure your confidence in being able to seek cholesterol and blood pressure screenings.
Please circle the number (1-5) that best explains how likely you are to participate in the behavior.

How likely are you to get your cholesterol checked…		Very Unlikely	Unlikely	Neutral	Likely	Very Likely
37	If you have to pay for it?	1	2	3	4	5
38	If you don't have a doctor?	1	2	3	4	5
39	If it is hard to get a doctor to take your insurance?	1	2	3	4	5
40	If you would lose work time?	1	2	3	4	5
41	If a close friend or family member tells you a screening is needed?	1	2	3	4	5
42	If you need a ride to your appointment?	1	2	3	4	5
43	If your friend tells you a screening is unnecessary?	1	2	3	4	5
44	If your last screening was normal?	1	2	3	4	5
45	If your last screening was abnormal?	1	2	3	4	5
46	If you are too busy during clinic hours?	1	2	3	4	5

Please complete the following information about yourself. The information you provide will be used for research purposes only and will not be shared with anyone outside of the research project.

1. What is your current age? ______ (years old)

2. What is your gender? ____ Male OR ____ Female

3. What is your height? ______ Feet ______ Inches

4. What is your current weight? ___________ Pounds

5. What is your race/ethnicity? (check only ONE)

____ White ____ African American ____ Hispanic ____ Asian/Pacific Islander ____ Other

6. Are you…. (Check only ONE)?
____ Married ____ Divorced ____ Widowed ____ Separated

____ never married (Single) ____ a member of an unmarried couple

7. What is the highest grade or year of school you completed?
____ Never attended school or only attended kindergarten
____ Grades 1 through 8 (Elementary)
____ Grades 9 through 11 (Some high school)
____ Grade 12 or GED (High School graduate)
____ College 1 year to 3 years (Some college or technical school)
____ College 4 years or more (College graduate)

8. Are you currently….?
____ Employed for wages
____ Self-employed
____ Out of work for more than 1 year
____ Out of work for less than 1 year
____ A Homemaker
____ A Student
____ Retired
____ Unable to work

9. Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare/Medicaid or Indian Health Services?

____ Yes ____ No ____ Don't know/not sure

10. Have you EVER been told by a doctor, nurse, or other health professional that you have any of the following (check ALL that apply):
____ Diabetes (high blood sugar)

____ Heart Attack
____ Angina (chest pain)
____ High Blood Pressure
____ Heart bypass surgery or a stent to open an artery
____ Congestive Heart Failure
____ High Blood Cholesterol
____ Stroke or mini stroke

11. Do you smoke cigarettes every day, some days, or not at all?

____ Everyday ____ Some days ____ Not at all

12. Have you had a test for high blood sugar or diabetes within the past three years?

____ Yes ____ No ____ Don't know/Not sure

13. How often do you participate in any physical activities or exercises such as walking, gardening, running, or golf for exercise? (Check only ONE)

____ Once a day ____ Once a week ____ 3-5 times a week ____ Once a month
____ I don't exercise

14. When was the last time you had your blood cholesterol checked? (Check only ONE)

____ Within the past 1 year ____ Within the past 2 years ____ Within the past 5 years

____ 5 or more years ago ____ Never ____ Don't know/Not sure

15. Where did you get your blood cholesterol checked most recently? (Check only ONE)

____ Doctor's office ____ Screening program ____ Hospital ____ I have not had my cholesterol checked

16. Do you intend to get your cholesterol checked in the NEXT month?

____ **Yes** OR ____ **No**

17. When was the last time you had your blood pressure checked? (Check only ONE)

____ Within the past year ____ Within the past 2 years ____ Within the past 5 years

____ 5 or more years ago ____ Never ____ Don't know/Not sure

18. Have you received any type of education about Blood Pressure and Cholesterol in the last 5 years? If yes, <u>where</u> did you receive the education?

____ Yes, ______________________________________
____ No
____ Don't know/not sure

19. Yearly *household* income:

____ less than $10,000
____ $10,000 to $19,999
____ $20,000 to $29,999
____ $30,000 to $39,999
____ $40,000 to $49,999
____ $50,000 to $59,999
____ $60,000 to $69,999
____ $70,000 to $79,999
____ $80,000 to $89,999
____ $90,000 to $99,999
____ $100,000 or greater

19. What is your zip code? ________________________

20. How far away is the closest town from your home? (Check only ONE)

___ I live in town ___ 1-5 miles out of town ___ 5-10 miles out of town ___ More than 10 miles out of town

21. How do you get to and from medical appointments (check one)?

____ Your own vehicle
____ Family member's vehicle
____ Friend's vehicle
____ Public transportation
____ Bicycle
____ Other: __________________________

APPENDIX B

Request for the Approval of Research Involving Human Subjects

Proposal

Title of the research project/teaching exercise: Using the Health Belief Model to understand cholesterol screenings in rural populations in central Texas.

Are you using subjects in research? Yes (yes or no)
Are you using subjects in teaching exercises? NO (yes or no)

Part 1: Expedited Review Request (if applicable)
The Baylor University Committee for Protection of Human Subjects in Research (Institutional Review Board or (IRB) has agreed to perform expedited reviews of certain research proposals that involve only survey research that poses minimal risk to research subjects. Proposals handled through the expedited review process are held to the same standard as those that go through the normal review process.

☒ I have reviewed the research or teaching exercise listed above. In my opinion, this proposal meets all three of the following criteria required for expedited review by the Baylor University Committee for Protection of Human Subjects in Research:

1. The only involvement of research subjects in the proposed research/teaching activity is response to written, oral, or electronic surveys;
2. The information requested in these surveys does not include any highly personal or sensitive information (reports of criminal activity or sexual behavior); and
3. The activity poses minimal physical and psychological risk to the research participant.

Part 2: Introduction and Rationale

Describe the research background and rationale for the project:
Cardiovascular Disease is the number one killer of U.S. adults, approximately 616,067 each year. (Xu, 2007). The biggest risk factors for Cardiovascular Disease are hypertension, high cholesterol, Type-2 diabetes, and lifestyle factors. Lifestyle factors include smoking, nutrition and physcial activity. A good indicator of risk for Cardiovascular Disease is cholesterol. Detection of high levels in these ares can prompt lifestyle changes that can help prevent or manage Cardiovascular disease (Mayo Clinic, 2011). This is especially needed in rural communities where the risk of dying of Cardiovascular Disease is 1.34 times more likely than their non-rural counterpart (Zuniga, 2003). However, rural communities have less access to primary care or screening

facilities in which to check their blood pressure, cholesterol, or blood sugar, as well as less access to treatment or medication if a diagnosis of Cardiovascular disease is given. Application of health behavior theory is useful for better understanding behavior and is important for understanding why a member of a rural community might particiapte in a cholesterol screening. The Health Belief Model (HBM) is a theory that has been frequently used to help understand participation in health screenings, particularly for breast cancer (Champion, 1987; Tavafian, 2009). HBM has also been used qualitatively to understand rural risk for cardiovascular disease, however quantitative measures of HBM constructs have not been developed (Hamner, 2010; Homko, 2008). The purpose of this research is to develop and pilot test HBM construct scales to better understand the use of cholesterol screenings in rural communities in Central Texas.

Clearly outline the questions being addressed
Question 1: Are the developed HBM measures valid and reliable?

Question 2: What is the perceived susceptibility and severity of high cholesterol in rural communities in Central Texas?

Question 3: What are the perceived benefits and barriers of participating in cholesterol screenings in rural communities?

Question 4: Are the constructs of the Health Belief Model related with cholesterol screening use?

Question 5: Does insurance status influence these relationships?

Describe any expertise you have in this area or research or teaching:
Tiffany Rose will serve as the principle investigator of this study and has research and teaching expertise on the promotion of health and quality of life. Tiffany Rose serves as a graduate teaching assistant and research assistant in the master of public health degree program at Baylor University. She holds a bachelor's degree in Biology and will graduate from Baylor's MPH in Community Health Education program in May of 2012. Her teaching expertise focuses on promoting health and quality of life among college students and adolescents. She teaches university students in a university wellness course and has worked with adolescents to address a variety of health issues (e.g., total wellness, physical activity, nutrition, body composition and image, sexual health, infectious diseases, drugs, tobacco, and alcohol). She has served as a project coordinator through Scott & White's Heart Aware Reaching Rural Populations (HARRP) Program under Dr. Catherine McNeal, providing health screenings and treatment to rural communities across central Texas. She has served as a research assistant for the study titled "Interdialytic Exercise in Renal Failure Patients" (under Dr. M. Renee Umstattd) and studies regarding women's health interventions health promotion among Kurdish women in Armenia (under Dr. Eva Doyle).

Dr. M. Renée Umstattd will serve as the faculty principle investigator and faculty advisor of this study and has research expertise focusing on the promotion of health and quality of life across the lifespan through physical activity. Specific research expertise areas include examining relationships among theoretical determinants of physical activity from a social cognitive and ecological perspective; implementation and evaluation of theoretically based physical activity interventions and the translation and dissemination of efficacious physical activity interventions into community settings.

Cite relevant research (including your own) in a bibliography:

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Part 3: Methodology

Thoroughly describe the methodology to carry out the project/teaching exercise:
The study will involve all members of the Holland, Bartlett, and Granger, Texas communities who are over 18 years of age and choose to participate. The survey will be offered through the Holland and Granger school districts. The survey will be given to other members of the Holland, Bartlett, and Granger communities through local churches and participants involved in the Heart Aware Reaching Rural Populations program currently being implemented by Dr. Catherine McNeal at Scott & White. Attached are support letters from each of the participating organizations. The community members will be invited to fill out the one-time survey preceded by completing an informed consent form with detailed information regarding the purpose and protocol of the study. Participation is voluntary and consent will be indicated by completion and submission of the informed consent form. Consent will also be indicated by the return of a fully completed survey since there is no identifying information of the survey form. To help ensure that confidentiality is maintained the following procedures will be followed:
•All surveys and informed consent forms will be labeled with identification numbers prior to survey administration.
•After data collection is completed, all surveys and informed consent forms will be stored separately in locked filing cabinets that will be accessible only by project investigators.

Incentives

Upon completion of a survey, each participant completing and returning an informed consent form will be entered into a drawing for one of ten prizes. The participants will have a choice of either a prize, such as a portable DVD player, MP4 player, or video MP3 player, or a check for $100. If the participant chooses the check option, he or she will be required to fill out a W-9, which will require personal information which will only be used to process the check. The name, phone number, and email of the participant will immediately be removed from the informed consent form and will in no way be connected to the completed survey.

Sample Size
The desired sample size to establish validity and reliability of the survey items should be 5 times the number of survey items, which is 225 (Garson, 2008). In order to establish more power and validity in the survey, a 95% confidence level with 5% error is desired. In order to achieve this out of a population of 3,500 people, at least 350 people need to complete surveys. In order to receive 350 completed surveys, response rates of the communities need to be considered. Rural Health services in various states, such as Montana and Pennsylvania, report and average of 42-48% response rates for rural communities (Montana, 2004; Pennsylvania, 2005). Disseminating eight hundred surveys allow the recommended allocation for a 42-48% response rate in the Granger and Holland communities. Obtaining eight hundred surveys should account for the response rate as well as incomplete surveys.

Data collection
Data will be collected through a one-time survey that will ask questions related to demographics and Health Belief Model constructs. The surveys will be disseminated through different organizations at varying times. These organizations include community school districts, churches, and the Heart Aware Program.

Survey instrument/Measures
The survey instrument has been adapted from Champion's Health Belief Scale for Breast Self-Exams (Champion, 1984), susceptibility items for Cardiovascular Disease (Tovar et al., 2010), and the Self-Efficacy Scale for Pap smear (Hogenmiller, 2007). An expert panel has reviewed the items to ensure face validity. The survey should take approximately 20-25 minutes to complete. The survey contains 45 questions measuring constructs of the Health Belief Model. In addition to Health Belief Model constructs, demographic questions are also included.

-Perceived Susceptibility will be measured by 7 items to examine a person's perceived risk of developing high cholesterol. These items will be measured using a 5-point Likert Scale, where 1 = strongly disagree and 5 = strongly agree.

-Perceived Severity will be measured by 8 items that will understand a person's perception of how severe high cholesterol and secondary disease, such as heart attack and stroke, will be if they get it. These items will be measure using a 5-point Likert Scale, where 1 = strongly disagree and 5 = strongly agree.

-Perceived Benefits will be measured by 4 items to assess effectiveness and reward of engaging in cholesterol screenings. These items will be measured using a 5-point Likert Scale, where 1 = strongly disagree and 5 = strongly agree.

-Perceived Barriers will be measured using 16 items that address problems faced in order to participate in a cholesterol screenings. These items will be measured using a 5-point Likert Scale, where 1 = strongly disagree and 5 = strongly agree.

-Self-efficacy will be measured using 10 items that will examine the person's confidence in his/her ability to get screened for cholesterol. These items will be measured using a 5-point Likert Scale, where 1 = very unlikely and 5 = very likely.

Data Analysis
Data will be analyzed using SPSS 19. Descriptive statistics, such as means and standard deviations, will be used to understand demographic characteristics of the sample and responses to HBM subscales. Exploratory Factor Analysis will be conducted to examine validity of the modified HBM scales. Cronbach's alpha will be used to calculate the internal consistency of the items. Pearson correlation coefficients and regression analyses will be used to determine if there are significant relationships between constructs of the HBM, intention and current cholesterol screening behavior. Subsequent multivariate analyses will be used to examine if these relationships are impacted when controlling for insurance coverage.

How many subjects will be used? 800 will be recruited (please see explanation above).

How will the subjects be recruited?
Subjects will be recruited through various organizations in the communities. Letters of support from both school districts, the Heart Aware Program, and two local churches can be viewed in the supporting documents. Consent forms and surveys will be disseminated to parents through the school system. The surveys will be conducted through Sunday school classes and Bible studies at local churches. Surveys will also be disseminated to participants of the Heart Aware program that is currently being implemented in these communities by Dr. Catherine McNeal at Scott & White. People who choose to participate and return an informed consent form will be entered into a drawing for one of ten prizes or checks for $100 as a token of appreciation for their time.
Possible risks to the subjects (both physical and psychological):
There is minimal risk in this study. It is possible that the subjects may feel uncomfortable talking about their knowledge of cardiovascular disease, their opinions of healthcare or why they choose not to participate in screening behaviors, such as barriers due to money or transportation.
Method(s) to limit risks:
Each participant will be given the opportunity to withdraw from the study at any time and participation in the study is entirely voluntary. All information will be kept confidential and will be fully de-identified.
Proposed safeguards to protect the subjects' right to privacy:
All participant information gathered through the survey will remain confidential and will be stored in a secured area (password protected computer and/or locked filing cabinet). Throughout the course of the study, all identifying information will be stored separately from collected data in a secure location and disposed of after incentives are disbursed. All data is de-identified to where each survey will be assigned a unique identification number that will not be associated with informed consent information. Participants will be notified of this in the informed consent form.
Outline the method(s) to be used to obtain the data, to analyze the data, and to disseminate the results of the research project:

Data will be collected through a one-time survey that will ask questions related to demographics and Health Belief Model constructs. The study will involve all members of the Holland, Bartlett, and Granger, Texas communities who are over 18 years of age and choose to participate. The survey will be offered through various organizations in these communities including school districts, various churches, and through participants involved in the Heart Aware program that is currently being implemented in both communities by Dr. Catherine McNeal at Scott & White.

Data will be analyzed using SPSS 19. Descriptive statistics, such as mean and standard deviation, will be used to understand demographic characteristics of the sample and responses to HBM subscales. Exploratory Factor Analysis will be conducted to examine validity of the modified scales. Cronbach's alpha will be used to calculate the internal consistency of the items. Pearson correlation coefficients and regression analyses will be used to determine if there are significant relationships between constructs of the HBM, intention and current cholesterol screening behavior. Subsequent multivariate analyses will be used to examine if these relationships are impacted when controlling for insurance coverage. Data will be reported in Tiffany Rose's Master's Thesis as well as being submitted to Journals for publication and national health organizations for presentation. A copy of the results will also be provided to the school nurses in each community and the Heart Aware program to help better reach the needs of the communities involved.

Part 4: Informed Consent Form Checklist

When using humans as subjects in research you must obtain their informed consent. Please upload a copy of your Informed Consent Form before submitting your proposal

I verify that the following items appear on my Informed Consent Form:

☒ A statement explaining the purpose of the research.

☒ A statement of the expected duration of the subject's participation.

☒ A description of the procedures to be followed.

☒ A description of any reasonable foreseeable risks or discomforts to the subject, including invasion of privacy.

☒ A description of any benefits resulting from the research, either to the subject or to others.

☒ A statement that informs subject of his/her right not to be a subject in a research project that is also a teaching exercise.

☒ A statement informing subject about how his/her anonymity will be guarded; i.e., that their confidentiality will be protected by assigned code numbers, by limiting access to data, by locked storage of files, etc.

☒ A statement that the subject's participation is voluntary, and that his/her refusal to participate will involve no penalty or loss benefits to which the subject is otherwise entitled, and that the subject may discontinue participation at any time without penalty or loss of benefits to which the subject is otherwise entitled.

☒ A disclaimer, if applicable, regarding the use of the Internet to collect data.

☒ For research involving more than minimal risk, an explanation regarding the availability of any compensation or any medical treatments if injury occurs (if applicable, see OHRP Reports).

☒ If written informed consent is required, a place for the subject to sign and date the form and a statement that a copy of the signed consent form will be given to the subject for his/her records.

☒ If the subject is a minor, a statement of parental responsibility in consenting to the child's participation in the study with a place for the parent to sign and date the form in addition to the participant's signature.

☒ The name, address, and telephone number of the principal investigator of the research project, and his/her affiliation with Baylor University. If the principal investigator is a graduate student, the name and telephone number of the faculty advisor is also required.

☒ A statement informing subject that inquiries regarding his/her rights as a subject, or any other aspect of the research as it relates to his/her participation as a subject, can be directed to Baylor's University Committee for Protection of Human Subjects in Research.

Part 5: Research Instrument(s)

Please upload any non-standard, newly developed interview or questionnaire instrument (one that has not been previously published) that will be used

also

Upload as appendices any other information pertinent to the proposal, such as consent letters from participating agencies, etc.

IMPORTANT:

You must share your proposal with your Faculty Advisor and Department Chair using the "Share this Project" feature in IRBnet. If your Faculty Advisor or Department Chair is not listed as an IRBnet user, contact them and have them register with IRBnet so you can share your project with them. Your Faculty Advisor and Department Chair must sign your project within IRBnet before submitting the proposal to the IRB.

APPENDIX C

Waiver of Informed Consent

Informed Consent Form

Title of Research: Using the Health Belief Model to understand cholesterol screenings in rural populations in central Texas.

Principal Investigator: Tiffany Rose. Graduate Teaching Assistant in the Department of Health, Human Performance, & Recreation housed within the School of Education, at Baylor University.

Faculty Principal Investigator: Dr. M. Renée Umstattd Meyer. Assistant Professor in the Department of Health, Human Performance, & Recreation housed within the School of Education, at Baylor University.

Sponsor: N/A

Thank you for showing an interest in being a part of this survey. Before you decide to be a part of this project, it's important that we explain the process clearly to you.

Explanation of Procedures:
Researchers at **Baylor University** are trying to be aware of the use of cholesterol screenings for cardiovascular disease in rural areas. The research results from this project will be used to help plan future health programs for the areas of Holland, Bartlett, and Granger, as well as other rural areas in the U.S.

What will you be required to do?
The study is about people living in rural areas. You are being asked to be a part of a one-time survey. The survey will be given during the year through the Holland and Granger School Districts. Surveys will also be distributed through local churches, and through the participants in the Heart Aware Program, which will reach members of the Holland, Granger, and Bartlett communities. The survey will take around 20-25 minutes to finish and you will be asked questions about your chance of illness, pros and cons of using screenings, views about screenings and other health questions. Being a part of this survey is not required and consent is given by signing and turning in this informed consent form, or by turning in a finished survey.

Risks:
One risk of being in this study is that you might not like to answer questions about your health status, or talk about your views about your healthcare. Any answers you give on this survey will be kept private and secret.

Benefits:
By being in this study, you will be entered into a drawing for the chance to win one of ten prizes: either a prize worth $100 or a check for $100. You will also learn more about your area's views of cholesterol screenings. You can also benefit by knowing that being a part of this study helps us learn more about rural areas, which will help in the Heart Aware Program and the creation of other future programs in your area.

Rights of people taking part in the research study:
The information you provide will be kept secret and private**.** Information from this study will only be used by the research staff or to contact you if you win the drawing. All data will be kept using password protected computers, websites, and/or locked filing cabinets. Please know that being a part of this survey **is not required.** If you choose not to take part in the study, there will not be a penalty. And, you may quit the study at any time. If you choose not to be a part of this study, the information that has been told to us will be kept secret and private.

The Baylor University Institutional Review Board (a group that looks out for the fair and just treatment of people in research studies) will review study records from time to time. This is to be sure that people in research studies are being treated fairly and that the study is being carried out as planned.

Cost:
The only cost to you is the time you will spend completing the survey.

Payment for being a part of the Research
If you choose to be a part of this study, your name will be put in a drawing for ten prizes: either one of the following prizes worth $100 or a $100 check. There will only be one entry per adult who fills out a survey. Your phone number and email (if you have one) are needed below so we may contact you if you win the drawing. Your phone number and email will only be used if you win the drawing and will be kept private and not shared with anyone. If you are contacted about winning the drawing, you will have 24 hours to respond.

<u>Drawing options include</u>:
Colby 7" LCD Portable DVD/CD/MP3 Player
Archos 35 HD Vision 8GB MP4 Player
Colby Electronics 2.4" 16GB Video MP3 Player
Sunbeam Heritage Series Black 4.6 Qt Mixmaster Stand Mixer
Keurig B31 Mini Plus Personal Coffee Brewer
Breadman Bread maker
Oster Extra-Large Convection Toaster Oven

Questions or Problems:
For more information about this research you should contact Dr. M. Renée Umstattd Meyer at (254)710-4029; One Bear Place #97313, Waco, Texas 76798; Renee_Umstattd@baylor.edu. Dr. Umstattd Meyer is an Assistant Professor of Health Education in the Department of Health, Human Performance, & Recreation at Baylor

University. If you have any questions about your rights as a research participant, you may contact Baylor's University Committee for Protection of Human Subjects in Research. The chairman is Dr. Michael Sherr, One Bear Place # 97320 Waco, TX 76798-7320, (254)710-4483.

STATEMENT OF CONSENT

I have read this form. I know what it says and freely agree to take part in the study based on what is said in this form. I will have a copy of this form to keep for my records.

Signature: ____ Date:___________

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Printed Name:____

***Email: ____**

***Phone number: ____**

(*This will only be used to contact people chosen to receive gift cards during the drawing.)

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